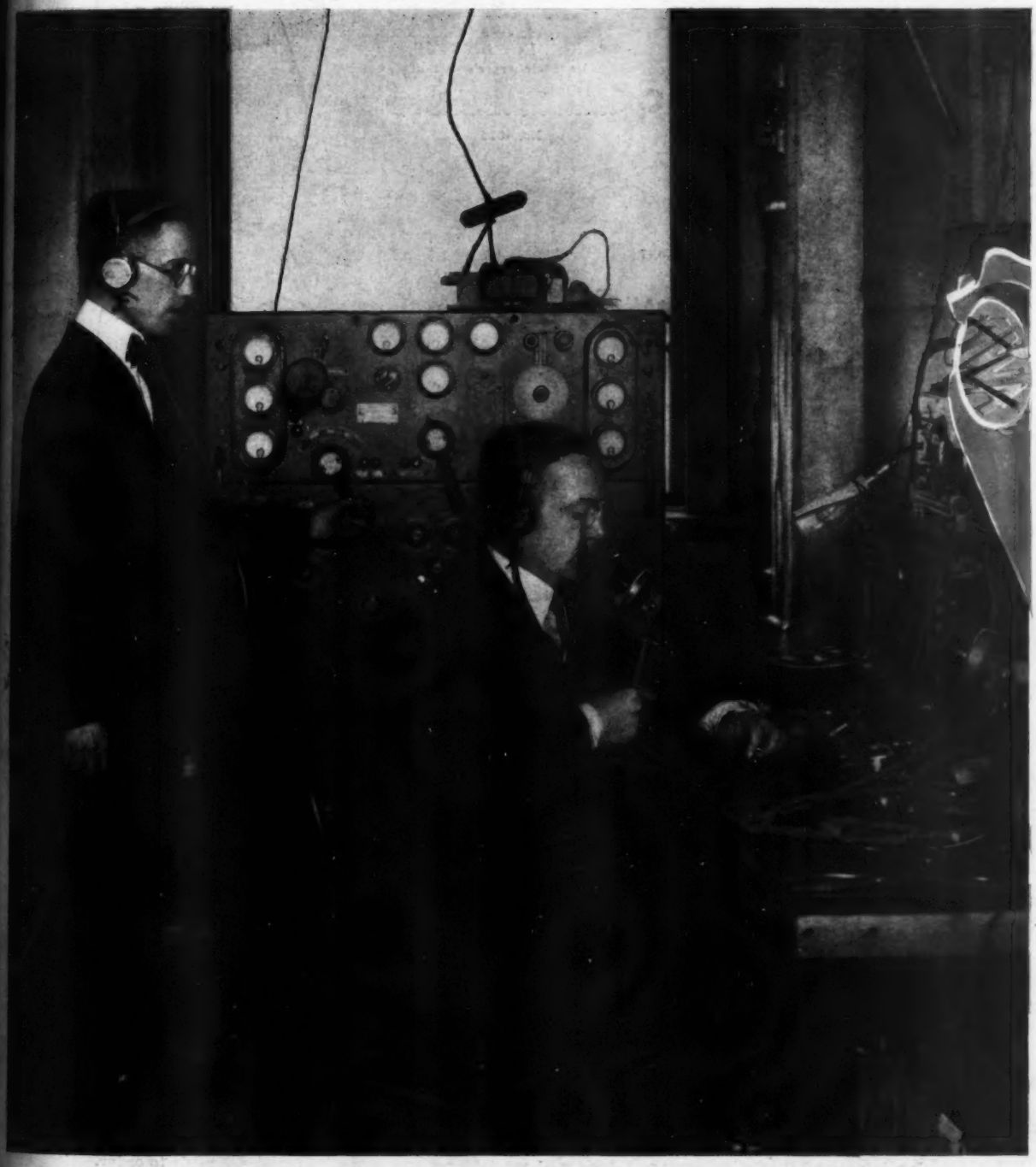
ugust, 1921

The WIRELESS AGE

25 Cents

Volume 8 Number 11



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Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

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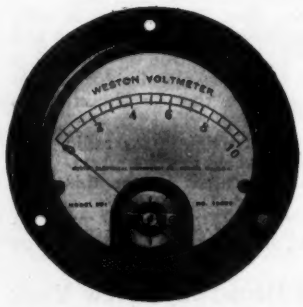

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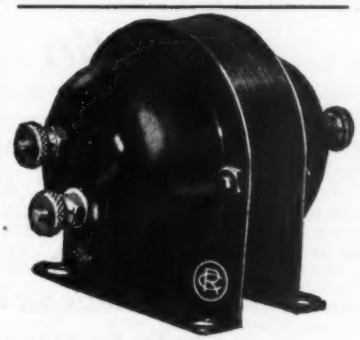

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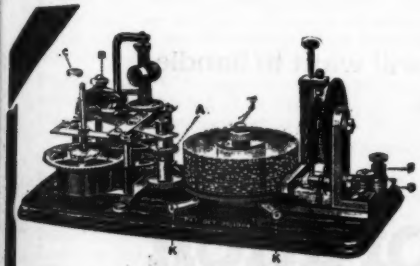

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to the

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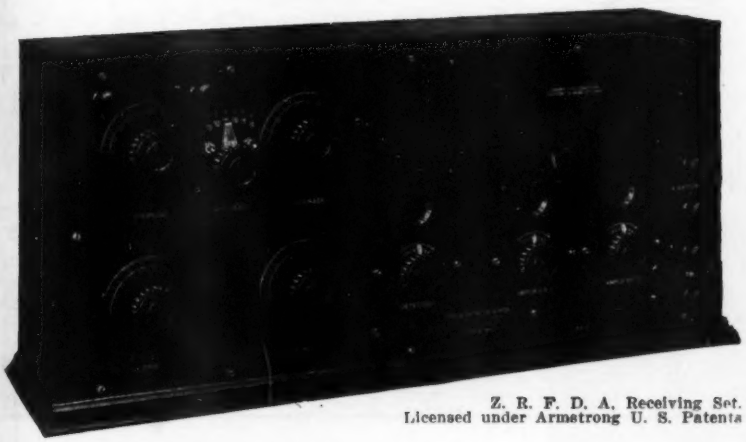

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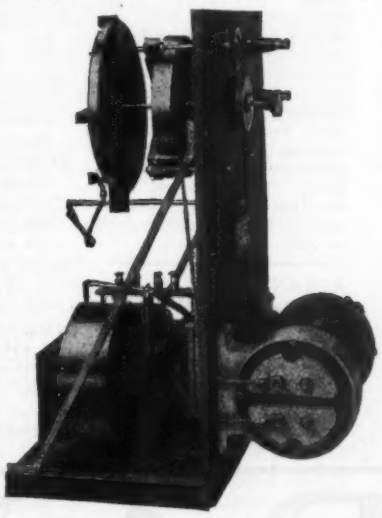

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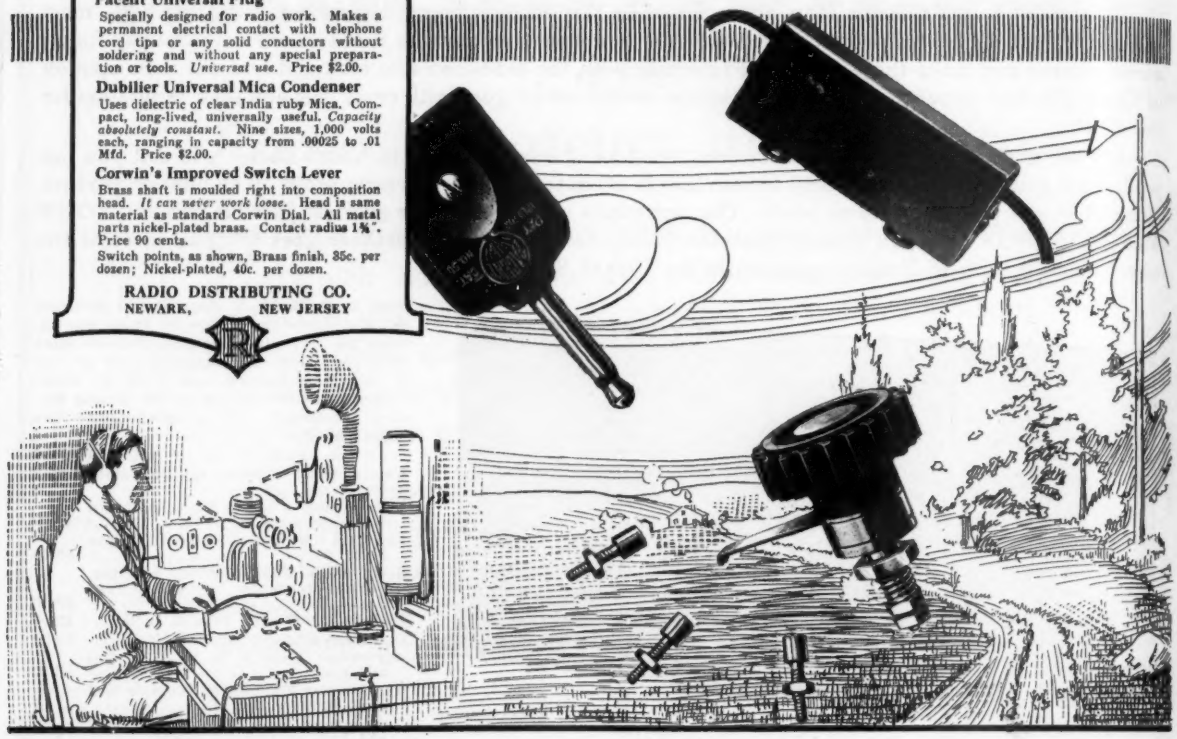

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VOL. 8. NO. 11 AUGUST, 1921

THE WIRELESS AGE

WORLD WIDE WIRELESS

...tish and American Radio Service Compared

...HARP criticisms of the paucity and slowness of com- ...munications by steamship, airplane, telegraph and ...eless between Great Britain and the overseas domin- ...s were voiced at the Imperial Conference, London, at ...hich a decision was reached to appoint a committee to ...sider the development of communications throughout ...e empire.

Premier Hughes of Australia made an unfavorable ...parison between the British wireless service and with ...e German installations that were in operation before ...e war as well as those at present existing in the United ...tates. He said the United States was conducting wire- ...ss services to England, France, Norway, Japan and Ger- ...ny and was arranging to cover other fields. He de- ...red America was daily radiating in every direction ...t only American news but American concepts of world ...nts and instanced the transmission of such news to ...ina, which, he said, formed its opinion of the British ...mpire thereon, while Great Britain did nothing. He ...ntended that if Great Britain and the dominions failed ... increase their wireless telegraph and wireless tele- ...one services in the immediate future, they would be ...t far behind other countries.

Premier Meighen of Canada said that while Canada ...d less cause to complain than Australia and New Zea- ...d, her exchange of news with the motherland was ...satisfactory.

News that comes to Canada, he asserted, filters through ...ew York, and is censored there, not by Government ...thorities, but from the American standpoint.

Winston Spencer Churchill spoke sympathetically re- ...rding these complaints. There is no doubt, he said, ...at the American press is able to collect its news on a ...st scale, and, having been paid the cost of this collec- ...on by internal circulation, it can afford to dump news ...o other English-speaking countries.

Iceberg Warnings by Radio

...ROM the United States naval hydrographic service ... comes the warning that there is more heavy drift ice ... the Atlantic Ocean this summer than there has been ...uring any season since the Titanic was sunk as a re- ...lt of colliding with an iceberg. The ice is already ...rther south than usual for the season, and is drifting at ... rate which reaches 40 miles a day in many cases.

Two cutters have been patrolling the edge of the ice ...rift for several months. They send out regular daily ...adio reports giving the location and speed of the floating ...ergs. Their reports are sent broadcast by radio from ...eadquarters so that all big shipping in the Atlantic has ...ll warning. Most of the large companies follow the ...ourse mapped out by the department and run little risk ...f encountering one of these dread ice mountains in the ...ourse of a voyage. Despite these precautions, however, ...wo freighters have recently been in contact with the ice.

Arlington Station Struck by Lightning

DURING a severe electrical storm which swept over Washington, D. C., and vicinity on June 26, lightning struck the big Navy Radio Station at Arlington, Va., just across the Potomac from Washington, and put the station out of business temporarily. None of the officers or men on duty was injured.

Early reports were to the effect that several transformers had been so badly damaged that the service would be interrupted for several days. Men were at once put to work, however, and the station was in operation again the next day.

Keystone Photo

Receiving news of the horse races by radio. The portable set is installed in an automobile

Radiophone That Can't Be Tapped

EXPERIMENTS now being conducted by Marconi's Wireless Telegraph Company in England, if successful, will revolutionize communication by telephone. The experimenters are said to have eliminated the two principal difficulties that heretofore have prevented the economical use of the wireless telephone by the general public.

In a report to the Department of Commerce Consul Wilbur T. Gracey at Birmingham, England, tells of the progress made by the company toward the utilization of wireless telephone through the elimination of these difficulties. New and novel principles have been introduced into the experiments.

It is believed the new system will make it impossible to "tap" messages and also that it will offer no obstacles to the ordinary telephone user, who will work through the medium of his ordinary instrument.

The present experiments are being conducted between London and Birmingham.

Berlin to New York by Radiophone Soon

GERMAN wireless experts expect soon to be able to reach New York from Berlin by wireless telephone, having already successfully bridge more than 2,700 miles equal to the air line distance from Berlin to New Foundland. The experiments were conducted by the Argentine steamer Bahia Blanca on a trip from Hamburg to Buenos Aires. Communications were maintained from the departure from Hamburg, first through the ten-kilowatt station at Koenigwustershausen, whose messages were heard until the steamer was 2,200 miles out.

The giant Nauen station, with a 130-kilowatt sender, then took up the task and was able to reach the steamer 500 miles more, until the Bahia Blanca entered a region where atmospheric disturbances regularly interfere with wireless transmission. The messages were heard with absolute distinctness at European land stations ranging from Bucharest and Madrid to Stockholm and Christiania, though they were not provided with the recently devised amplifying receiver.

Underwood Photo
The Rev. Edgar Sherrod using the radiophone to perform the marriage ceremony of a couple sailing the skies in a balloon

New Canadian Radio Stations

THE Alaska Wireless Telegraph Company is considering the possibility of introducing a wireless service between Edmonton, Alberta, Can., and Fort Norman, according to information received at the Board of Trade offices here from Falcon Joslin, president of the concern. The Edmonton Board of Trade is taking up the matter and will investigate the proposition. The Canadian Government is installing four wireless receiving stations between Peace River Crossing and the Arctic Ocean, according to T. A. P. Frost of the Soldiers' Civil Re-establishment Board, who has just returned from a trip to the far north on departmental business.

Radio Newspaper From Airships

INITIAL trials will soon be made in the publication of a daily newspaper from airplanes in flight—a new phase of journalism.

Airplanes will leave Paris and London daily. Machines from Paris will print editions of the Aerial Mail in French and those from England will print their copies in English. Batches of the papers will be dropped by parachute in Boulogne, Rouen, Amiens and other cities where there are subscribers, says the Daily Mail.

The machines will be equipped with wireless in addition to complete printing plants and will issue news of politics, finance, sport and that of a general character.

Government Radio Stations Shut Down

DUPLICATION of work and lack of money is the reason given at the Charlestown Navy Yard for the order from Washington to close down two radio stations one at Siasconset and the other at North Truro.

Radio Control of Ships a Success

THE efficient performance of the battleship Iowa under radio control during the recent aerial bombing tests may lead to revolutionary changes in naval development, officers believe. Without a soul on board the Iowa was manoeuvred from the battleship Ohio, five miles away, with the utmost precision, and there was not a hitch in the mechanism in more than two hours while the Iowa was being bombed.

It was a scientific triumph. The Iowa was a real "Flying Dutchman," that mythical crewless ghost of the seas, as she obeyed the will of Capt. F. L. Chadwick on the Ohio, almost hull down on the horizon. The invisible, magic fingers of the radio reached out across the sea to whirl the Iowa's steering wheel, operate the fuel oil and water supply valves and start and stop the ship.

So perfectly did the control function that the officers of the Ohio manoeuvred the Iowa away from the attacking air forces at the moment the bombs were being released, varying the speed of the target vessel at will.

Army and Navy officers who witnessed the test were much impressed by the possibilities of development of the radio control idea for use in future wars. It was said to be apparent that radio control might eliminate some loss of life in such enterprises as "block ship" operations as when the British undertook at Zeebrugge and Ostend to bottle up German submarines.

A movement is afoot to install radio control on at least one more obsolete battleship and two old destroyers, to serve as targets for aerial bombing practice and further experiments with radio control. Extension of experiments to the possibility of applying the radio control idea to aircraft also is under consideration.

The entire radio control idea is in its infancy, naval officers believe, and they expect great improvements in the efficiency and scope of the control within the next few years.

Radio Fire Alarm

A NEW YORK genius has hitched up a wireless apparatus to the automatic sprinkler by means of which an alarm of fire is sent broadcast as soon as the sprinkler is thrown into operation.

Grand Opera by Radiophone in Europe

WIRELESS telephones enabled people in Copenhagen, Vienna, and other cities within a 600-mile radius of Berlin to hear "Madam Butterfly" almost as well as those sitting in the State Opera House, Berlin, recently.

Reports from receiving stations within this radius state that this first attempt to send an entire opera by telephone was entirely successful, the orchestra as well as the voices of the singers being heard distinctly.

A number of experiments in wireless telephony have been made in Germany recently, but this is considered the most important. Microphones installed at the front of the stage and connected with the central Government sending station made it possible. Similar apparatus will be installed in the Philharmonic, Berlin's largest concert hall, soon.

International Radio Conference

THE International Wireless Conference, called for the discussion of wireless communication questions, was formally opened at the Sorbonne June 21 with representatives of the United States, France, England, Italy and Japan in attendance.

Maj. Gen. George O. Squier, Chief of the Signal Service of the United States Army, who heads the American delegation of military and civil experts, replied to the address of welcome by Paul Laffont, the French Under Secretary of State for Posts and Telegraphs. General Squier told of the keen interest the American Government was taking in world communications.

Other speakers emphasized that wireless in future would be a practical means of communication, and they urged the necessity of co-operation by the various countries in drawing up uniform rules.

The purpose of the conference is to harmonize the radio rules of the world and formulate plans for bringing wireless into more general use through the encouragement of private enterprise under Government control.

The American Government has a delegation of ten of its best military and civil experts, headed by Major Gen. George O. Squier, Chief of the Signal Service of the United States Army. Others in the party include Professors A. E. Kennelly of Harvard, J. H. Dellinger of the Bureau of Standards of the Department of Commerce, Major J. A. Maubourgne, for the United States Army; Admiral Magruder and Captain G. R. Evans, representing the American Navy, and Dr. Louis Cohen. General Squier also is representing the State Department.

It is said that the question of the island of Yap will not come up in any form before the conference, although world wireless communications as they exist will be reviewed and discussed.

Great Britain has a large delegation, of which Admiral of the Fleet Sir Henry B. Jackson is the head.

The conference is an outgrowth of the communications conference held in Washington last October.

Sermons by Radio

SERMONS by wireless are being delivered by the Rev. Isaiah W. Sneath, pastor of the Congregational Church of Wollaston, Mass. Two experienced radio operators who are members of his church sit in specially prepared places in the church and flash the minister's words broadcast. Rev. Sneath says he has adopted the method as "a means of enlarging his congregation." The sermon is transmitted on spark telegraphy. The call letters are 1BW and the wavelength 200 meters. One-quarter kw. is used and the sermon has been copied as far as Washington, D. C. R. H. Shaw is the owner of the station.

MacMillan Arctic Expedition to Receive Daily Radio Reports

THE auxiliary schooner Bowdoin, in which Capt. Donald B. MacMillan, the Arctic explorer, is to sail later this month for Baffin Land, slipped out of port recently. Her immediate destination was Portland, Me., where she will ship fuel before proceeding to Wiscasset, Me., her point of departure for the Northern Seas.

The schooner is equipped with a powerful wireless outfit with which she expects to receive daily news reports from the world she has left behind. At noon each day she will also rate her chronometers from the Arlington time signals.

Radiophones in Alaska

THE keepers of the lonely lighthouses at Cape Sarichef and Scotch Cap at the entrance of the Unamak Pass will soon be able to talk to ships at sea and with wireless stations along the Alaska Coast.

This improvement in the communication system of Alaska is being made by the United States navy collier Saturn, which is establishing radio telephones in the North. The vessel arrived in Seattle after installing wireless telephones in the lighthouses at Cape Sarichef and Scotch Cap, which guard the entrances to Unamak Pass, the gateway to Bering Sea.

Persons in the lighthouses soon will be able to talk by radio telephone to Dutch Harbor, where there is a powerful wireless station. Dutch Harbor can send the messages by radio to Southwestern Alaska, where they can be relayed by cable to the United States.

Keystone Photo
The Rev. Isaiah W. Sneath, the first minister in the East to deliver sermons by radiophone

Danish Discovery Explained to London Engineers

A NEW electrical force, by which infinitely small electric currents are able to perform work out of all proportion to their magnitude, was described to a crowded gathering of the Institution of Electrical Engineers, of London, by Alfred Johnsen and Knud Rahbek, who had been invited to come to London to repeat the remarkable experiments they have recently made in Copenhagen.

The discovery is of the simplest character. It is that certain minerals such as slate or agate, when in contact with a piece of metal, stick together with intense firmness when even an excessively minute electric current passes through them.

A slate cylinder, for instance, is slowly revolved with a metal band round it. As soon as a current passes through the two the cylinder is stopped dead or the band held tight. A heavy lithographic stone was picked up by a brass disc only two inches in diameter when a current of extreme feebleness passed through it — so feeble that it made no difference even when the current passed first through the body of one of the lecturers.

What this means in practice is that a few thousand extra miles would make little or no difference in sending a wireless message. The rate of receiving wireless telegraph messages can be speeded up to several hundred words a minute, and so forth.

Home Is Bought Via Wireless

UNIQUE in the annals of real estate selling is a deal closed by R. D. Lang of the Lang Realty Company, San Francisco, Cal., with Morgan Ross, owner of the Lincoln Hotel — a transaction negotiated and consummated entirely by means of radiograms between San Francisco and Honolulu.

Prior to his departure Ross had inspected and admired the handsome eight-room stucco house in the exclusive section of Forest Hill, but it was not until after he had arrived in Honolulu that he definitely decided to purchase it. Fearing that it might be sold before his return to San Francisco, he took the quickest means available to secure it.

Ross's new home is situated on the corner of Magellan and Cortez avenues and the amount involved in the transfer was $20,000.

The Wireless Memorial Fountain

THE Wireless Memorial Fountain erected some years ago in Battery Park in memory of Radio Operators who lost their lives at sea in the performance of their duty, and which has been in the custody of the Maritime Exchange, has now been transferred to the care of a committee of six, consisting of two Directors of the Maritime Exchange: Captains Jacob C. Reichert and James P. McAllister; two officials of the Radio Corporation of America: Messrs. E. B. Pillsbury and J. B. Duffy, and two representatives of the American Radio Operators: Benjamin Beckerman and Samuel Schneider.

The Committee held a meeting at the Maritime Exchange, June 29th, and elected Mr. E. B. Pillsbury President and Secretary, and J. B. Duffy, Treasurer.

It was voted to appeal to the Park Department to have the Memorial renovated and secure better atte tion to its maintenance.

France Installs Radiophone Control of Train-Despatching

THE Nord system of French railways will be the fir in Europe to install wireless telephones for the co trol of train movements. Work has already commenc on receiving antennae to be attached to a statue surmoun ing the Gare du Nord, the principal Paris station, and special registering apparatus has been designed by M Branly.

For the present the system will only connect the Ga du Nord with individual stations as far as Creil wi occasional intermediary sending posts attached to tel graph posts along the line, which will be useful in ca of accident. As the efficiency of the system is prove however, the company intends extending it as far as Du kirk, with interstation service as well as long range de patching control.

Other French railways are watching the experime with interest, as it is expected to make obsolete all bloc systems and to reduce the control costs by at least 7 per cent.

Wireless on India's Ships

THE Government of India is considering the advis bility of compelling all vessels hailing from Indi ports to carry wireless. It is stated that the use wireless is essential on ships plying in Indian water as they could then receive warnings enabling them t avoid steering into the vortex of a cyclone.

Radio Compass Annual Report

THE yearly report of the Navy Department covering radio compass activities shows that for the year 1920 there were 29 stations in service which furnished 35,726 bearings, to 15,374 vessels, the average time required for a bearing being 5.1 minutes.

This is the first year that an attempt has been made to keep any sort of permanent record of the work at shore radio compass stations. While the records are not as complete as they might be, due to the system being changed and improved during the first few months, the report does bring out very clearly the great value of this service to shipping, as is attested by many excellent testimonials from captains of vessels who have been furnished bearings, sometimes in heavy weather when conditions were such as to cause doubt and anxiety.

The total number of bearings furnished vessels by the naval direction finding stations during 1920 was as follows:

ATLANTIC AND GULF COASTS

Stations	Months	No. of Bearings
First District		
Bar Harbor, Me.	8	475
Gloucester, Mass	12	1161
Deer Island, Mass.	12	1114
Cape Cod, Mass.	3	140
Chatham, Mass.	2	57
Surfside, Mass.	12	2183
Price's Neck, R. I.	8	679
Watch Hill, R. I.	4	68
Third District		
Montauk, L. I., N. Y.	12	1095
Fire Island, L. I.	12	2527
Sandy Hook, N. Y.	12	2899
Mantoloking, N. J.	12	2865
Fourth District		
Cape May, N. J.	12	3258
Bethany Beach, Del.	12	2965
Fifth District		
Hog Island, Va.	12	2135
Cape Henry, Va.	12	3023
Cape Hatteras, N. C.	12	3295
Cape Lookout, N. C.	12	2615
Sixth District		
North Island, S. C.	11	222
Morris Island, S. C.	11	477
Ninth District		
Pass a Loutre, La.	5	126
Burrwood, La.	5	163
Grand Island, La.	5	118
PACIFIC COAST STATIONS		
Eureka, Calif.	2	109
Point Reyes, Calif.	3	449
Bird Island, Calif.	3	429
Point Montara, Calif.	3	427
Farallon Isl., Calif.	3	334
Arguello, Calif.	1	18
Total		35,826
Total bearings furnished per month per station		153.7
Total bearings by district		
First District		6,277
Third District		9,386
Fourth District		6,223
Fifth District		11,068
Sixth District		699
Ninth District		407
Pacific Coast		1,766
Total		35,826

The importance and value of the radio compass service to shipping is officially recognized by the United States Shipping Board in Bulletin No. 51, as follows:

The attention of all masters of Shipping Board Vessels is directed to Bulletin No. 32, dated April 15, 1920, in relation to radio and signal service, and all masters are directed to familiarize themselves with provisions of same at once.

Your particular attention is directed to paragraphs 8 and 9, which concern the use of Radio Compass Stations and submarine signals and blinkers.

Masters will find on their pilot charts for the various months of the year a complete list of United States radio compass stations, together with full directions concerning service they are equipped to render. You note same carefully.

You are further advised that in all case future strandings of United States Shipp Board vessels, a careful inquiry will be held determine what use masters of said strand vessels have made of this radio compass s ice, and if upon investigation, it is found said stranding could have been avoided by proper use of said Radio Compass Stations quest will be made to the Steamboat Inspec Service for the revocation of the license of officer or officers at fault.

The fact that this order is being forced is shown in the following le concerning the stranding of a Shipp Board vessel which could have used direction finding service, but whose offic neglected to do so.

December 9, 19

From: Division of Operations, U. S. Shipp Board Emergency Fleet Corporat Washington.

To: Director Naval Communications, Wa ington, D. C.

Subject: S. S. Knoxville: Failure to rely Radio Compass bearings.

Sir: Your bulletin No. 13 for October November contained a paragraph concern the stranding of the S. S. Knoxville of L Beach on October 16th, 1920, while wi range of the Sandy Hook and Mantolok radio compass stations.

In this connection your attention is invi to our weekly bulletin of November 27th, which we advised that the Master of ship had been discharged for inefficiency a result of a report submitted by the r operator to the effect that he did not ask radio compass bearings.

This action was taken in line with the po indicated in our Bulletin No. 51, a copy which I am enclosing herewith. You note that we consider it a serious offense a Master to neglect to use the facilities of naval radio compass stations.

L. R. RUTTER,
F. P. GUTHRIE.

When compared with Radio, the great arena holding 90,000 spectators was smaller by far in area and audience

Voice-Broadcasting the Stirring Progress of the "Battle of the Century"

How the Largest Audience in History Heard the Description of the Dempsey-Carpentier Contest Through Use of the Radiophone

TO listeners breathless with expectation came the words: "Seven . . . eight . . . nine . . . ten! Carpentier is out!! Jack Dempsey is still the world's champion!"

Thus was the climax reached at 3.34.26 o'clock on the afternoon of July 2nd. A multitude—not less than 300,000 persons—tense and eager, were hearing at that instant the voice that sounded loud and clear throughout the Middle Atlantic states. The magic of the radio telephone had accomplished new wonders. A daring idea had become a fact.

A triumph . . . It was more than that. It was history in the making. Radio has had its triumphs. Great distances have been spanned in the past, nations and continents have been connected; even has the voice been carried across the sea. But everything in the past record of wonders but adds to the lustre of this latest amazing demonstration of broadcasting a voice to the largest audience in history.

The great thrill came after months of preparation and universal excitement. Trainloads of newsprint paper and tons of ink had prepared millions of persons for "The Battle of the Century"; miles of type had been set to tell of the wonders of the great arena, specially erected in Jersey City at a fabulous cost. Money was spent like water to bring to the sides of that little 18-foot squared enclosure several hundred expert observers, famed for their descriptive powers, so that the public could have vivid word-portrayals of the athletic contest between the ablest fistic experts of the old and the new worlds. Peoples all over the civilized globe sat up and marveled at the preparations.

Quietly, inconspicuously, almost unnoticed in the frenzy of preparation, radio was made ready for the dramatic moment. And when it arrived—a new communication record was set up for history!

A record . . . and the ushering in of a new era. For while the eyes of the world were awaiting the issuance of the time-honored descriptive printed word to tell the story—radio told it by voice! Instantly, through the ears of an expectant public, a world event had been "pictured" in all its thrilling details.

And to what an audience! The great arena where 90,000 persons gathered to witness the contest, held but a fraction of the audience that radio assembled. That famed Jersey City site, Thirty Acres, was but a dot in the vast area of 125,000 square miles within which auditors gathered to follow the tide of battle by radio's spoken word.

The appeal to the imagination is boundless. Forecasts for the future now can be made a subject for pleasant, stimulating and practically endless speculation. But the present has its story to tell. It is the recital of the facts of an accomplished task. So, taking it chronologically, the main points are these:

The idea of describing the world's championship boxing contest by the spoken word was first presented to Tex Rickard, the famous promoter of sporting events, some three months before the scheduled date of the event. Julius Hopp, manager of the Madison Square Garden concerts, impressed with the skill of New York amateur radio men as disclosed at the Second District Convention, recognized the possibilities of radio voice reporting of the descriptive features of the struggle for supremacy between Jack Dempsey and Georges Carpentier. The idea appealed to Mr. Rickard, and stirred the imagination of his business associate, Frank E. Coultry. Matters were left in Mr. Hopp's hands, and he set about the task of securing the required apparatus and personnel.

Manufacturers, individual amateurs, clubs and radio organizations of all characters were made acquainted with the plan. General offers of co-operation were returned in some cases; in others, the scheme was thought to be impracticable. The president of one organization that has long occupied a prominent place in amateur affairs, restricted the possibilities to a head phone receiving proposition, placed the ultimate range of a radio telephone at 100 miles, and gave his opinion that means for making the voice satisfactorily audible to large audiences in halls had not been developed. At the same time, this amateur organization turned down the project.

Such an attitude was easily understandable, for voice

broadcasting on the scale contemplated had no precedent. The National Amateur Wireless Association's officers felt differently, however, and within a few hours after being notified of what was wanted they accepted, without qualification, the task of transmitting and receiving the voice. Technical difficulties were recognized and respected; but in radio, obstacles exist only to be removed. Confidence in the amateurs, and the knowledge that highly expert engineers could be secured to rise to any demand, made the fact that the proposition called for new departures in communication engineering only more interesting. It was looked upon as a co-operative effort toward an achievement worth while. And that is what it turned out to be.

Every individual who participated earned as much credit as the next one. It took courage to undertake even the smallest part of the program, and each amateur who receives one of the certificates of participation can look upon it as something better than a souvenir; for it is a testimonial to his confidence in his own ability to take an essential part in an historical event.

Upon the officials of the National Amateur Wireless Association fell the technical burden and the administrative task of organizing the amateurs, mobilizing apparatus and overcoming each technical obstacle as it presented itself. But at the Association's Headquarters the point was never lost sight of, that the individual amateur was the connecting link. It was this confidence in the harmonious and effective working which could be thus accomplished that resulted in the firm arrangement made with Tex Rickard and his associates, Mr. Coultry and Mr. Hopp, for the N. A. W. A. to take over exclusively the radio arrangements. That the amateurs rose to the occasion is now history; how well they accomplished their task they, themselves, tell later on in this article.

The first problem for the N. A. W. A. officers was the selection of a transmitter; the second, was the site. Then came the preliminary organization of details. Several months were thus occupied, but on June 10th, when the word went forth, calling upon the amateurs for their co-operation, the Radio Corporation of America had agreed to furnish the transmitter, the Lackawanna Railroad had loaned the use of its towers at Hoboken, and telephone lines had been arranged for, connecting direct with the ringside. Representatives of the American Committee for Devastated France and the Navy Club, in whose hands the securing of theatres and halls was concentrated, had then started out on trips to various cities and towns within a radius of 200 miles of Jersey City. A vast amount of preparation had therefore been completed before the aid of the amateurs was summoned, and the value of this preparation is readily seen in the extent of the territory covered. As the project grew the arrangements for securing theatres and halls were entrusted to Mr. Hopp by the American Committee for Devastated France and the Navy Club, and this feature of the work was from then on directed from the office of the former organization.

The selection of operating personnel for theatre assignments was largely governed by the information contained on the application blanks. The information there given proved to be an excellent guide to the qualifications of the amateurs who offered their services. As the applications began to come in, however, it was evident that the wholehearted response had special significance. The amateur spirit of tackling the unknown was eloquently disclosed, for in practically all cases reception on 1600 meters was entirely new. They hadn't the equipment in many instances, and at least half of the volunteers had done no previous listening on that wavelength. The majority of the courageous ones who tackled the job had to resort to makeshift apparatus and face the additional handicap of responsibility to large gatherings of people. There were numerous cases of "cold feet," but these were offset by the many who saw the benefit to amateur progress in a departure from the more or less irresponsible playing around on 200 meter wavelengths, and eagerly grasped the opportunity to undertake a task that called for perfect reception and amplification. Amateur radio owes more than a casual debt of gratitude to the few hundred progressives who have by their achievement awakened the field at large to the knowledge that there is a place for brilliant work outside 200 meter undertakings; hundreds of letters received at N. A. W. A. headquarters stress the point that the fight description broadcasting has pointed the way to the utility of amateur radio in a larger, more in eresting field.

SOME IMPRESSIONS

By J. ANDREW WHITE

Now that it's all over, I don't mind saying that describing the big scrap so it would convey "pictures" to you listeners, was the toughest reporting job I ever tackled. Jammed up against the ring, in a little coop without elbow room, and with the hot sun beating down, and bedlam breaking loose on every side . . . it's a wonder it sounded even intelligible. The men punched quicker than could be noted by speech. Their speed baffled the tongue; even the eye was strained. I could give only the "high light" punches—the ones that did some damage.

Harry Welker was monitor of the Thermos-bottled ice water. He recalled its purpose, eventually. I'd been talking, then, steadily for two hours and a half.

And those telegraph keys! Three hundred of them clacking and chattering. Back of them the leather-lunged "advisers" telling the favored contestant, and the world, how Atta Boy should finish the other.

That fourth round had all these trimmings and one thing more. 'Member that, "stiff left and a right to the jaw," just before Carpentier went down for the count of nine? Well, Carp's 172 pounds of muscle were within some eight inches of my unprotected head when he began to fall. Only a single rope—and the wild thought that I *must* continue to talk without interruption—intervened to stay the execution of the natural safety-first inclination. Fortunately, he dropped forward, when he crashed.

Just before the mighty warriors came out for the great battle, I received a message from Hoboken, and wrote it out at the ringside. It was from the operator of Lafayette Station at Bordeaux, France, wishing Carpentier success. When the likable French champion came into the ring he bowed his acknowledgement and a few smiles to us in the radio coop. It wasn't the first time we'd met, by the way; do you know that Carp's a regular, full blown, member of the N. A. W. A.? Jack Dempsey's face brightened up, too, when a greeting came to him from our beaver-board enclosure. Jack's a real amateur ham; radio is his regular evening diversion in his training periods.

Can't help liking Jack. He's not very pretty, but he's a clean sportsman. You should have seen the appeal to the Referee in the American's eyes when the Frenchman was down for the first count. Jack didn't want to hit him again. It wasn't necessary; and he knew it. This brute strength business that everyone talks about is all poppycock. And nothing could be more naive and natural than the way he sprang forward at the final ten and lifted up his gallant opponent in his arms.

The next thing, now that it's over, is to arrange a get-together of the amateurs who heard the crowd cheering and those who liked the voice of Mr. W. J. Wye. Maybe they can tell us why the market has been bullish on honeycomb coils.

And who was it that first discovered the automobile type of Dictograph, plus an obsolete phonograph horn and a 6-volt battery, made *some* radio speech amplifier?

It's worth something, too, to know how differently a Magnavox sounds when it's operated by Davis, who arrived from the Pacific Coast in the midst of the excitement and became the life of the party in several locations at once.

Speaking of and to the Live Ones, the dozen fellows that sent in copies of the description should know that I'm truly grateful. It's only through these that I know what I said. The roar of the crowd drowned out my own voice, for me, and afterward I was wondering just how much sense the description conveyed.

One thing that is growing clearer every day, however, is the need for newspapers giving a fair share of the credit where it properly belongs. If an amateur can't earn individual credit for his work in his own home town, something is wrong. Those who were cheated should write now to managing editors of their respective newspapers, if only to set things straight for the next event.

There was real news value in some of the receiving stunts. A roped-off miniature ring was erected by the students in the main classroom of the Radio Institute of America. Matt Bergin refereed the audibility contest.

But read the article itself; these side remarks only touch here and there. The article covers things in quite some detail; for (taking you into my confidence) 'twas written especially for the Radioist who phoned in to ask us to talk louder because he couldn't hear Hoboken on his bulb and two stages. We strive to please . . . particularly the deaf and dumb.

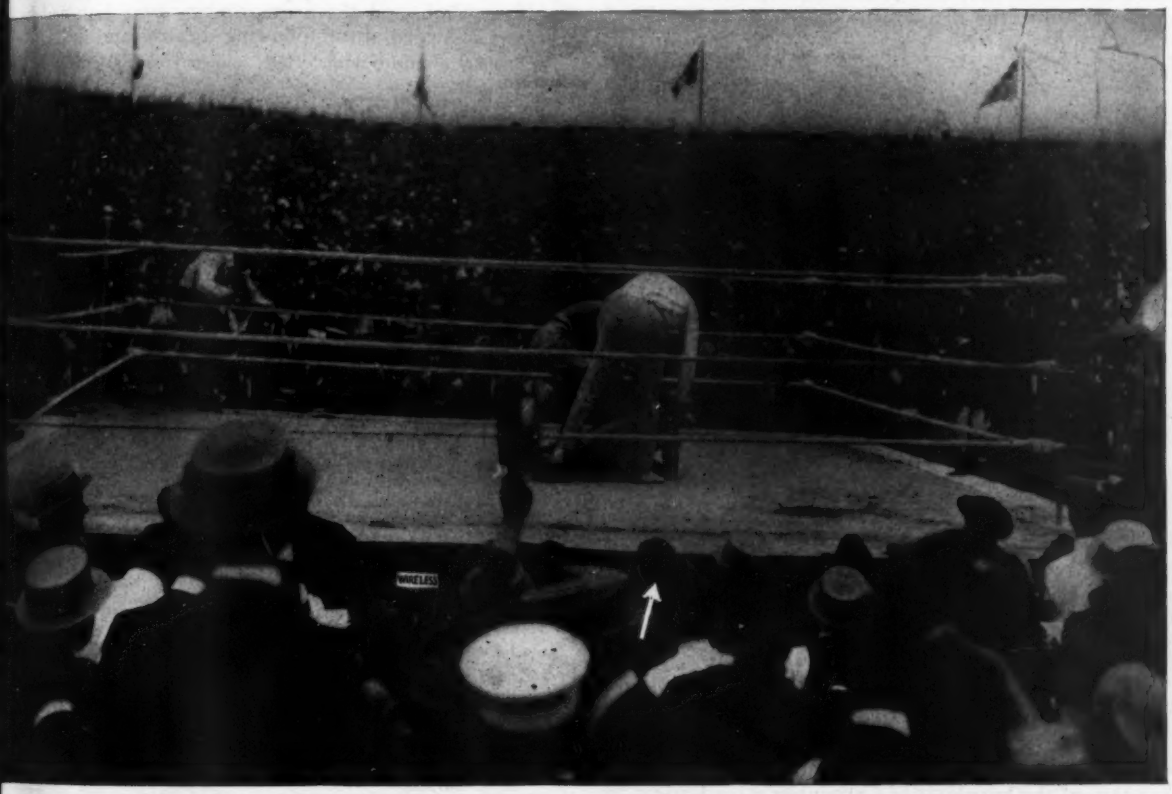
Solely from the amateur's viewpoint, the voice broadcasting of July 2nd is looked upon as marking up a new high level. Letter after letter contains the gratitude of writers that amateurs have at last had the opportunity to participate in an undertaking that really meant something, and which gave the amateur a man's size job.

There is now an insistent demand that the idea be kept alive, that large scale broadcasting to audiences, through the amateurs, be expanded to include voice descriptions of baseball games, all sorts of sporting events, speeches by noted men, lectures and every imaginable form of musical entertainment. Enthusiasm has reached high pitch, as the doubters have been silenced.

when the whole plan had been placed before the Radio Corporation of America, use of the equipment was definitely arranged for.

At first it was intended to install the transmitter at the ringside in Jersey City. But erection of an adequate antenna equipment looked to be a proposition too expensive for an undertaking in which the proceeds were for charity, so that was abandoned. The Lackawanna Railroad had just what was wanted and the use of its towers at Hoboken was quickly secured. Then, through the enthusiasm of L. B. Foley, the railroad's superintendent of telegraphs, several trunks on the land wire telephone switchboard were set aside exclusively for the connection to the ringside.

When the first preliminary test of transmission to



This photograph, taken immediately after the fatal ten was counted, shows the wireless booth at the ringside; the arrow points out J. Andrew White, acting president of the N. A. W. A., the observer, who described the contests for the radio audience

Now, as to how the record-breaking broadcasting event was accomplished:

About the first thing determined was the wavelength. It was obvious that a full success could not be accomplished unless the possibility of interference was eliminated; that made 1600 meters look good, and when Commander D. C. Patterson, the District Communication Officer, gave assent to the use of this Navy wavelength and assurances that the Navy would keep out on the afternoon of July 2nd, that problem was settled. Later on, Chief Radio Inspector Arthur Batcheller accomplished wonders in getting the special license through and by notifying everybody who was likely to be using a wavelength near 1600 meters, that a lot of silence during the dramatic hour would be appreciated. These steps followed close upon the securing of the transmitting set. That detail was largely a matter of acquaintance with the day-to-day status of the radio art. The officials of the N. A. W. A. knew, for that is part of their qualifications, where the most powerful available radiophone transmitter lay. It was at the General Electric works at Schenectady, and the amateurs occurred, as scheduled, on the evening of June 24th, practically every detail of the program had been completed. Every evening during the entire week before the international boxing contest took place, voice broadcasting was continued for several hours. Each evening more power was used, and the reports from the amateurs were carefully checked to determine the adequacy of the range. On July 1st, the night before the contest, the full power was put on for the first time. This transmission was announced to be typical of what could be expected on the following eventful afternoon. A deluge of reports followed; eight telephone trunk lines were in constant operation in the endeavor to receive the out of town telephone calls as fast as they were coming. Three persons were constantly employed in answering the telephone calls, but it was found absolutely impossible to keep up with the incoming stream of reports from six or seven States on the Atlantic seaboard. By nine o'clock that night there was not the slightest question of the following day's success; amateurs throughout the entire territory which it had been planned to cover had re-

ported the set to be working at 100 per cent. efficiency as to strength of signals and clearness of speech.

No untoward incidents occurred on the long-awaited day which followed. In accordance with a last minute change in plan the voice was not transmitted direct from the ringside, as originally intended. J. Andrew White, acting president of the N. A. W. A., described the preliminaries and the main bout, talking over the direct wire from the ringside, and this description was repeated by J. O. Smith (2ZL) word for word into the radiophone transmitter at Hoboken.

How accurate and vivid was the description, needs no comment—the hundreds of thousands who heard it, can tell that side of the story best. It is of additional interest, though, that due to the almost instantaneous re-transmission, the result was known by radio ahead

How it was done; close-up view of Mr. White talking from the ringside, accompanied by Mr. Welker, who acted as an auxiliary observer

of the fastest telegraph reports and the actual blows that caused the knockout of Carpentier were known by the radiophone listeners many minutes before the newspapers or other public sources of information had the definite knowledge. The radio telegraph, too, instantly flashed the result to Europe from the main telegraph office of the Radio Corporation of America at 64 Broad Street, New York, where a special operator hung expectantly over the key awaiting the voice in the radio receiver to report the outcome.

There are, literally, a thousand and one angles from which to view the achievement, but space limitations prevent their recording in this article. So, turning to the next feature of primary interest, the powerful radiophone that did the job at Hoboken, it may be of interest that this transmitter, built by the General Electric Company and installed by the Radio Corporation of America, employed six 250-watt Radiotrons, three used as oscillators and three as modulators, when on telephone or buzzer modulated output. For straight continuous wave telegraphy all six Radiotrons were used as oscillators.

The power necessary for the operation of the tubes was obtained from a motor generator, the voltage of which was 2,000 D. C. A separate winding on the direct-current motor provided alternating current for filament heating. A transformer with neutral top was employed to obtain the proper voltage.

The antenna consisted of four wires and was of the usual T type, the flat top 450 feet long. At an average height of 250 feet it was swung between the 400-foot steel tower and the clock tower of the Lackawanna Terminal. The ground system used included copper roofs of the train sheds and several low buildings, a network of tracks and a system of pipes running into the salt water of the Hudson River.

The fundamental period of the whole antenna and ground system was 750 meters and the wavelength on which the reports were transmitted was 1600 meters.

Halls and theatres were operated under contract between the American Committee for Devastated France and the Navy Club, and the arrangements were handled by amateurs indicated at the following theatres and halls:

Bridgeport, Conn. Colonial Hall; audience of 500 enjoyed the returns.
F. M. Ham (Bridgeport Radio Club)
Wilmington, Delaware. The Playhouse entertained an audience of 574.
W. S. Wilson.
Albany, N. Y. Odd Fellows Hall held an audience of 100.
F. H. Myers.
Mt. Vernon, N. Y. Merchants and Manufacturers Association had an audience of 100.
H. J. Hasbrouck.
Newark, N. J. Kruger's Auditorium; audience 303.
A. Wester (Radio Club of Irvington, N. J.)
Paterson, N. J. Lyceum Theatre; audience 289.
E. M. Graf (Paterson Radio Club).
Bridgeton, N. J. Criterion Theatre; audience 358.
Bridgeton Radio Club.
Bethlehem, Pa. Coliseum; audience of 200.
Lehigh Valley Radio Club.
Asbury Park, N. J. Park Theatre, had audience of 264.
H. J. McCullom.
Yonkers, N. Y. Elks Club; audience of 100.
Edwin H. Armstrong.
Perth Amboy, N. J. Majestic Theatre; audience 250.
John J. Hallahan.
Elmira, N. Y., Mozart Theatre; audience of 200.
Harold Perkins.
Freeport, L. I. Auditorium; audience of 199.
John G. Newberry.
Williamsport, Pa. Majestic Theatre; audience of 200.
F. J. Demarest.
Stamford, Conn. Elks Hall; audience of 100.
J. Edw. Brown.
Springfield, Mass. Plaza Theatre; audience of 410.
Springfield Radio Club.
Trenton, N. J. The Arena; audience of 408.
Amandus Wentzel.
Cranford, N. J. Greenford Theatre; audience of 150.
T. J. Larsen.
New Haven, Conn. The Arena; audience 100.
J. T. Butler.
Utica, N. Y. Gaiety Theatre; audience 790.
George M. Benas.

New York City:

Van Kelton's Stadium, 8th Ave., 57th St.; audience 547.
F. J. Brick.
Loew's New York Roof, Broadway & 45th St.; audience 1200.
Mrs. Eleanor Regan.
Burland's Open Air, 985 Prospect Ave.; audience 168.
M. W. Woodman.
Oval Gardens, Southern Boulevard & 163rd St.; audience 221.
Nat. Sauberman.
Majestic Roof, St. Nicholas Ave., 185th St.; audience 265.
L. M. Cockaday.
Loew's American Roof, 8th Ave. and 42nd St.; audience 409.
Fred. A. Gritzner.
Moorish Gardens; audience 496.
Fred Rosebury.
Brighton Beach Music Hall; audience 500.
A. H. Rodde.
Queensboro Athletic Club, L. I. City; audience 500.
Wm. F. Diehl.
Sumner Theatre, Brooklyn; audience 300.
Earl Kullman.

In addition to the foregoing list the voice broadcasting was received in a number of theatres where an admission was charged, including six theatres arranged for in the Pittsburgh district and assigned to the Westinghouse

Company, concerning which no report has been received. Detailed figures and total number in the audiences are therefore not available as we go to press.

Additions or corrections received will be published in the next issue.

In a great many places where no hall or theatre had been contracted for by the organizations concerned, enterprising and enthusiastic amateurs undertook independent affairs of their own and also took up collections for the benefit of the cause. A detailed report of these undertakings follow:

W. Harold Warren writes from Asbury Park, N. J., as follows: "My compliments to you for your excellent work during the Dempsey-Carpentier bout. Owing to your perfect enunciation, your clear and vivid descriptions, and your calm and measured speech under such exciting surroundings, I was able to obtain perfect reception in a roller chair on the Asbury Park Boardwalk, using a new type of loop, a detector, and a two-step amplifier, equally as good whether the chair was in motion or at rest. The cheering of the crowd could be distinguished and each sound of the gong seemed as though it were but a few feet from the roller chair instead of in Jersey City, notwithstanding the fact that we were but 100 feet from the noise of the breaking surf. I have sent a check for $13.00 and photo to the N. A. W. A. Again congratulating you."

At Smithtown, L. I., A. E. Jackson entertained a few friends and sent $1.80 as a donation.

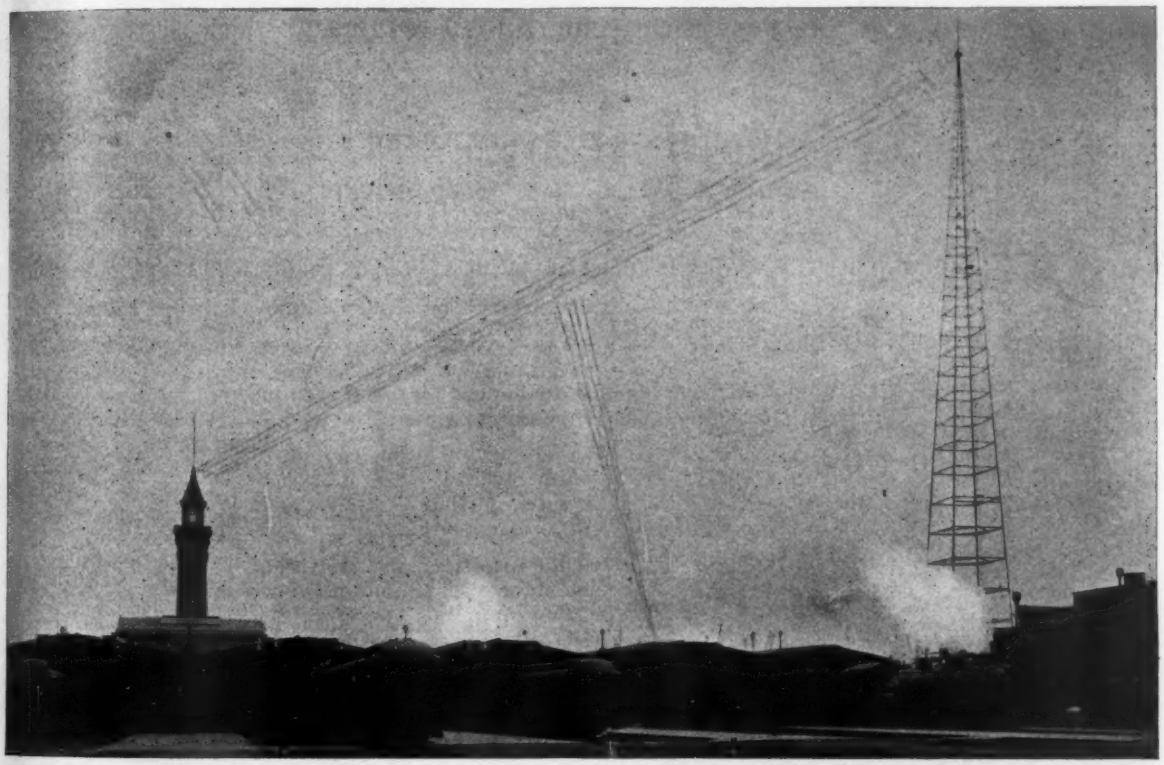
G. N. Vacca of Newark, N. J., enclosed money order for $3.50 secured through a small gathering of his friends. He states that people who have previously listened on his set to other radiophone stations generally experienced trouble in understanding speech but that on Saturday everyone understood ever word from the Hoboken station.

From Eastport, Maine, G. C. Brown sent a donation of $2.00 and reported that the voice description was heard well using only one UV-200 Radiotron. Eastport, Maine, is approximately 425 miles air line, from Hoboken.

At Leighton, Pa., R. A. Gerhard rented a small hall for $10.00 and made the returns available to an audience of eighty-three. He forwarded the balance, $10.75, as a donation to the cause. He stated that the broadcasting was a great success, the voice carrying clearly through the hall and that everybody was pleased.

At Sea Cliff, L. I., W. R. Nordmeyer, on an equipment entirely home-made with the exception of one vacuum tube, heard the entire voice broadcasting and made it available to a small gathering. He remitted $28.36 taken up as a contribution.

First Ward Hose Co., of Morristown, N. J., sent a check for $25.00 which was made up in a collection taken by the Company. The treasurer states that an audience of approximately 500 were able to hear all of the returns of the preliminaries and the big fight. The entire fire house was packed on both floors. By means of a two-step amplifier and two large phonograph horns attached to head telephones, every word was made clear to the audience on the first and second floors.



The aerial installed at the Lackawanna Terminal at Hoboken, N. J., was four-wire, T-type, 450 feet long with an average height of 250 feet

George J. Smith organized a small gathering of village notables in the fire house at Valley Stream, L. I., and forwarded a contribution of $9.43.

C. Waddington states that the voice came in so loud at Clark Mills (ten miles from Utica, N. Y.) that it could be heard several feet away from the telephones. He enclosed $3.50 as a contribution.

Horace A. Beale, Jr., president of the Parkesburg Iron Company, Parkesburg, Pa., set up a temporary station at the baseball grounds in Parkesburg and the broadcasting was made available for a large number of people. A check for $50.00 was forwarded as a contribution.

At Brooklyn, N. Y., Kenneth Swezey and several friends listened to the report of the Dempsey-Carpentier fight and he says that they were all greatly impressed

In Grateful Appreciation

The Undersigned have caused the issuance of this testimonial to

Mr. American Amateur

as a permanent record of invaluable co-operation in making available to the American public a description transmitted by radio telephone of the

World's Championship Boxing Contest

Jack Dempsey, United States

vs.

Georges Carpentier, France

Held at Jersey City, N. J., July 2nd, 1921

This certificate officially testifies to the expert assistance rendered voluntarily by its holder and essential participation in the reception of broadcasted radiophone reports employed in this manner for the first time in history, making possible the successful accomplishment of the following objects:

Promotion of amity between the nations represented in the greatest international sporting event on record

The unprecedented undertaking and scientific triumph of simultaneous transmission of the human voice to 300,000 persons without the aid of wires, including audiences in theatres within an area of 125,000 square miles

The contribution of financial and material aid in the task of rehabilitating the war-torn and devastated regions of France and bringing relief to an heroic people

Aiding establishment and maintenance of a home, hotel and club for enlisted men of the United States Navy and Marine Corps

In pursuance of the united resolutions formally adopted by the signatories hereto, this testimonial has been issued under seal and date of July 15, 1921.

National Amateur Wireless Association

J. Andrew White
Acting President

American Committee for Devastated France

Anne Morgan
Chairman, Executive Committee

The Navy Club

Franklin D. Roosevelt
President

Jack Dempsey

G. Carpentier

G. L. Rickard

Frank E. Conroy

Julius Hopp

Specimen of the certificate of participation which is being sent to all amateurs who successfully conducted the reception for audiences and thereby contributed to the fund of the designated charities

with the capabilities of the radiophone "which is now being used to full advantage." He enclosed $1.00 as a contribution. C. Milanio also conducted a small affair at his home and remitted $1.00 as a contribution.

From Poultney, Vt., F. C. Fassett reports that the voice was strong during the entire broadcasting and that the ringing of the gong between rounds could be clearly heard all over the hall. He forwarded $5.69.

R. S. Johnson sent word to the city officials of Red Bank, N. J., and their friends to attend a reception of the returns. A fair crowd was on hand at 1 o'clock and he was in the midst of numerous questions when, "hello, hello, this is WJY, Hoboken, New Jersey, speaking," broke in on the room and the crowd was instantly silenced. The affair was an entire success from beginning to end and the hat was passed; $36.50 was dropped into it and has been sent in. He states that from an experimental standpoint the event will go down in history as a most wonderful accomplishment.

R. E. Brigham of Oneonta, N. Y., states that ten friends listened to the radiophone returns and considered the event remarkably successful. They heard every word and all were well pleased and commented favorably upon the clearness of the speech. Mr. Brigham enclosed a check for $17.00 as a contribution.

At Tarrytown, N. Y., Old Post Road Garage was used by Fred Koenig because he was unable to secure a hall. He set up his receiver in the show room of the garage, "which by the way," he adds, "was not large enough to accommodate the large crowd which came to hear this wonderful description of the fight by wireless telephone." A collection was taken up to the amount of $35.50, which has been received. Mr. Koenig had hand-bills printed and distributed throughout Tarrytown and the surrounding country before the fight.

Frank Nowotny was unable to be at home at Orange, N. J., on Saturday during the broadcasting, so he had another young man operate his receiving set for the benefit of several neighbors, with the stipulation that they must all contribute to the cause. He enclosed $2.00 as the amount of the collection taken up.

A. G. Sidman received the returns at the Montclair (N. J.) Athletic Club and enclosed a contribution of $10.00.

D. W. Ormsbee accidentally heard of the intention to broadcast the results of the big fight from a fellow commuter and succeeded in hearing the voice very clearly and entertained several friends at Massapequa, L. I. He enclosed $15.00 as a contribution.

At Shelton, Conn., A. R. Kulich entertained thirty people who were able to clearly understand every word of the broadcasting and has sent $8.00 to be added to the fund.

At Sag Harbor, L. I., J. Henry Ronkens, Jr., entertained a small audience which was extremely enthusiastic over the excellent results obtained. He enclosed $3.00 for the fund.

From Rhinebeck, N. Y., George Rosenkranz reports that he had just recently installed a receiving set and was surprised when he found how clearly he could hear the speech from Hoboken on it. He entertained several friends and took up a collection to the amount of $30.73, which has been received.

At Langhorne, Pa., five persons heard the returns as clearly as if the voice was coming from the next farmhouse. J. Edgar Hires enclosed check for $5.00.

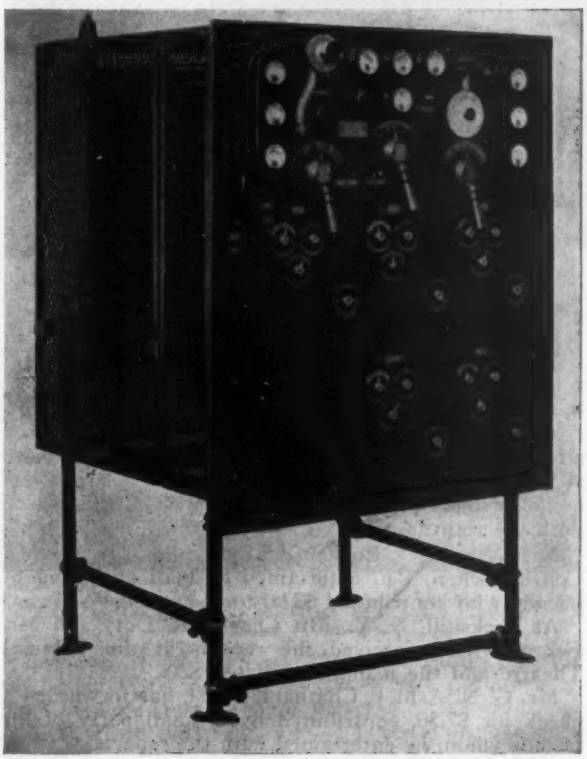
At Summit, N. J., Robert N. Brockway, Jr., and Leonard Richards, conducted a gathering at a small hall and collected $45.00 which has been remitted.

At Altoona, Pa., C. O. Amos received the voice broadcasting of the big fight successfully through considerable static, he used a loud speaker in a theatre. When, at the conclusion of the voice description, the result was broadcasted by telegraphy, using straight C. W., the signals were so loud they drowned out the orchestra. He enclosed money order for $4.00 as a contribution from the amateurs concerned in the undertaking.

From Naugatuck, Conn., Daniel E. Noble reports reception of the fight returns a total success and heard by 500 people assembled in a hall. The voice was as loud as it would have been had the speaker been present shouting a description in the hall. Everybody was highly pleased with the demonstration. He enclosed a check for $55.35.

J. O. Smith, the well-known amateur operator of 2ZL station, who handled the radiophone installed by the Radio Corporation of America at Hoboken. Mr. Smith repeated into the transmitter each word of the description as it was received from the ringside.

Below, the set itself; this powerful record-breaking radiophone transmitter employs six 250-watt Radiotrons with 2000 volt D.C. generator for power supply.

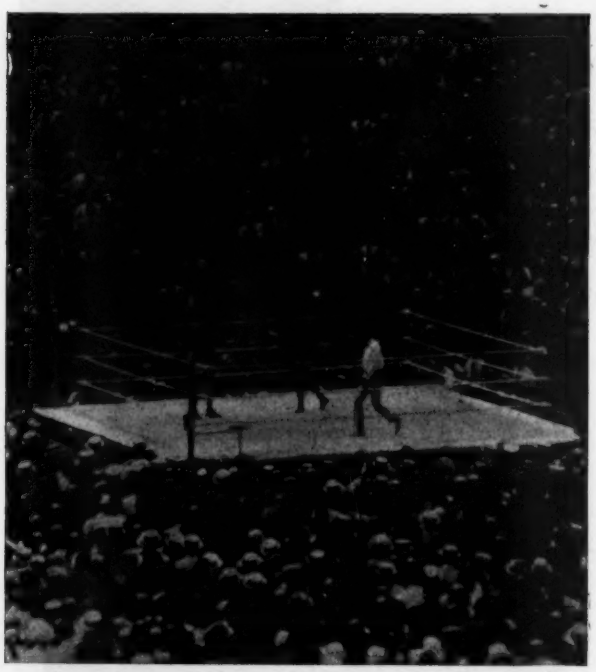


C. R. Vincent of the Plainfield Radio Association arranged for the reception of the returns at the Shackamaxon Golf Club, Westfield, N. J. The entire voice description of the fight was clearly received and everybody was surprised and delighted. A check for $50.00 was sent in to be added to the fund.

Paul B. Murphy enclosed a money order with his letter for $10.00, which was obtained from a small gathering at the Nyack (N. Y.) Boat Club. He states that the quality of transmission over the radiophone was excellent and that the returns themselves were of a character that exceeded even the highest expectations.

From Hoboken, N. J., J. D. Elmdorf, of the Young Men's Christian Association, advises that one of the members experimented in the reception of the voice returns on July 2nd and after a little adjustment was able to hear the voice clearly. They passed the hat among those who listened in and secured $6.00, which has been sent to us to be added to the fund.

At the Nyack Boat Club, Nyack, N. Y., Mr. Paul B. Murphy made it possible for a party of members to listen to the reports. A collection, amounting to $10, has been received from this gathering.



The focal point of the world's interest on the afternoon of July 2nd showing at the left of the ring the wireless phone booth from which the story of the contest was told

Mr. W. B. Thurman, 13A East 37th Street, personally brought to this office $3.25 which was taken up at a small gathering at his home.

At Buchanan, N. Y., Mr. Michael Lounz entertained a few friends who contributed $7.75. The reports were received on the lawn of his home under a large tree, and everybody was comfortable and very much pleased with the returns.

Mr. Wilfred P. Luckens, 527 Spring Mill Avenue, Conshohocken, Pa., entertained a small gathering of friends who contributed $2.00 to the cause.

At Peekskill, N. Y., Mr. Charles R. Doty and Mr. George Olsen received the reports at the Colonial Theatre and the manager donated $20.

Mr. G. N. Ashley, Chatham, N. Y., has forwarded a check for $7.50, contributed by a small party of his friends whom he entertained with the reports.

At the Radio Institute of America, 326 Broadway, New York, the hat was passed by the instructor, Mr. M. L. Bergin, and $25 was contributed by the students and employees of the Institute.

At Woodmere, L. I., Robert C. Birkhahn entertained a party of friends and the entire voice broadcasting was voted a most wonderful achievement. He enclosed $5.00 as a contribution to the cause. *

* The total amount received at N. A. W. A. headquarters from small undertakings handled entirely by the amateurs either in small halls, in homes and in some cases in wood-sheds, is approximately $600. The theatre receipts, remitted direct to the American Committee for Devastated France and the Navy Club, were of course much greater.

Reports containing remarks of listeners from a number of scattered points throughout the district covered by the voice transmission tell the story eloquently. The complete success is clearly indicated in the following extracts selected at random from many hundreds of reports received:

At Hardwick, Vt., the voice was loud through the entire fight and the preliminaries, and was heard without trouble, using two steps of amplification (distance 300 miles).

On the yacht "Eagle," owned by W. K. Vanderbilt, the operator accidentally ran across the voice description while tuning his set, when 125 miles from New York on Long Island Sound. The voice was fine and clear, and Mr. Vanderbilt, his guests, and all of the crew, were able to hear the description of the preliminaries and the big fight itself. The operator reports that the millionaire and his friends were very much impressed.

An amateur at Auburndale, Mass., held his receiving headphones against land line telephone transmitter and the voice description was received at a nearby golf club with sufficient audibility to be heard over a room by attachment of a megaphone to the receiver of the land line telephone.

At Swansea, Mass., (Cape Cod) the entire fight description was heard clearly on a home-made set, one-step amplification.

At Lawrence, Mass., the entire fight was received on a home-made set with two-step amplifier.

At Providence, R. I., all details were received clearly with good audibility, using one-step amplification.

The speech was exceptionally good at Greenwich, Conn. Audibility was sufficient to enable listeners to hear every word fifteen feet away from telephones.

From Donora, Pa., (35 miles southwest of Pittsburgh and 350 miles airline from Hoboken) an amateur reported temperature of 90° in the shade, in spite of which all of the fight broadcasting was received clearly. He states that while returns of th ebig fight were being received from Hoboken, the Westinghouse station at East Pittsburgh, Pa., came on the air and made the announcement that no fight returns had yet been received.

The entire voice description of the big fight was received at Jamaica, L. I., on an old wire clothes line fifteen feet long, using a galena detector.

From Greenport, L. I., an amateur sent a complete copy of the voice broadcasting including the preliminaries and it checks as being substantially correct. His report states that the voice was much more clear than over a telephone line to New York City. Greenport is 105 miles air-line from Hoboken.

At Albany, N. Y., the entire fight returns were received clearly and distinctly on detector and one-step of amplification. Six pairs of telephone receivers were connected in circuit.

At Stamford, Conn., the entire fight description was heard clearly by twenty-five people by attachment of a megaphone as a loud speaker.

The voice was heard clear and distinct through considerable static at Buzzards Bay, Mass.

At Bourne, Mass. (Cape Cod), the voice was clear and the description of the entire fight was received without trouble.

Bristol, Pa., received the voice clearly, distinctly and strong.

At Bourne, Mass. (Cape Cod) the voice was clear and loud with two steps of amplification. There was considerable static here.

At Camp Arey, Orleans, Mass. (Cape Cod), the voice was distinctly audible. Bulletins were telephoned to the local village paper and moving picture show.

Every word was distinctly heard through heavy static at Jessup, Md.

At Devault, Pa., the voice was strong, clear and easily read through considerable static. The words were audible with the phones lying on the table.

As no hall or theatre was secured at Clifton, N. J., John J. Kulik organized a small undertaking of his own and entertained a group of friends and neighbors. The audibility of the voice at Clifton was such that the entire fight description could be heard 200 feet away from the loud speaker horn.

B. D. Heller of Fordham, N. Y., writes as follows: "The description of the fight was simply wonderful. Even the gong sounded plainly as could be. The broadcasting was received on a little, old loose-coupler, silicon detector and single phone I had stored away for years and only got it out to get my boy started in wireless during vacation. Never expected to hear a 'World Crier' by radiophone. You must have been heard over thousands of miles. Some 'Town Crier' I'll say! Almost thought I was in the front row at the ringside when you counted Carpentier out. It was realistic and impressive to the highest degree."

Harry B. Fischer, of Brooklyn, writes as follows: "With a 2-step amplifier connected to a small size loose coupler and with the above inserted in two megaphones the voice could be heard clearly and distinctly through three rooms of our apartment, where fifteen persons assembled."

Mrs. H. W. McMann of 380 Riverside Drive, New York, writes that her son was participating in the reception of the returns at one of the local theatres and that as the afternoon wore on and she began thinking about the fight she got to the point where she could no longer restrain herself and listened in on her son's receiving set. She then describes, in detail, the reception of the fight and pronounces it so remarkable as to be almost unbelievable.

From Bayonne, N. J., W. A. MacMaster writes that the audience at his home ranged in age from eleven to forty-five years and everyone was intensely interested. He reports that they all agreed that the case of the wireless amateur took a great stride forward on that Saturday afternoon, and has forwarded a resolution, signed by all those who listened to the returns at his home, requesting that a similar detailed description by radiophone be made of the 1921 World's Series baseball games.

Miss Mary M. Maurer of Hillside, N. J., writes that her young brother had some difficulty at first in tuning-in the voice and that as she is opposed to prize fighting generally she at first refused to help him, but after hearing a few words come through she got so excited she forgot all about her prejudice against prize fighting. With the set she entertained her entire family, including her grandmother.

E. L. Versfelt of Montclair, N. J., states that his antenna consisted of a single wire hidden in the moulding of a second story room. Total length of wire twenty-eight feet. The voice was audible all over the house.

N. W. Meitzler states that he made every effort to secure a hall at Allentown, Pa., but was unsuccessful. He attempted to borrow a megaphone from a local music store, but as Saturday was their busy day he was unsuccessful. He finally rigged up a megaphone in connection with one Baldwin head telephone and in this way entertained a large gathering at his home.

Captain C. H. Batchelder of the S. S. "Acropolis," radioed thanking the N. A. W. A. for the fight reports received 400 miles at sea. He stated that every word was clearly understood on board the "Acropolis."

Frank Saalmueller entertained eight persons at his home at Newark, N. J., hearing the entire voice broadcasting on a crystal detector.

Roy Fisher of Philadelphia, Pa., reports the entire broadcasting clearly heard by ten persons, megaphone and Baldwin head telephone used as a loud speaker. His guests were very much surprised at the clearness of speech and the vividness of the description.

At Richmond Hill, N. Y., Frank Jacobs had eight guests and only four pairs of telephones, so they took turns. The voice was clear and easily understood. He states that he has purchased an amplifier and a loud speaker in anticipation of the next voice broadcasting from Hoboken.

Benjamin F. Cutler writes from Stonington, Conn., that the voice description of the preliminaries and the big fight and the ringing of the gong between rounds was clearly heard. He says that the news of the fight by radiophone was just as good as being at the ringside.

Arthur H. Lynch, from Brooklyn, reports the entire voice broadcasting heard clearly; he had eight sets of head telephones connected to a single tube.

The New York Theatre, in the heart of the metropolis, which held the largest audience, featured the radio report for days in advance of the event

R. Henry Strahlman received the voice broadcasting for the benefit of the patients, doctors, nurses and others at the Montifiore Hospital in the Bronx.

A. H. Townsend of Newark, N. J., states that his entire family of six people listened to the radiophone returns using only a crystal detector, one pair of head telephones and a megaphone used as a loud speaker horn.

Dr. Gordon M. Christine of Philadelphia received all preliminaries and the big fight without a hitch, and could also hear the ringing of the gong between rounds. He states that it certainly is a great advance in broadcasting news.

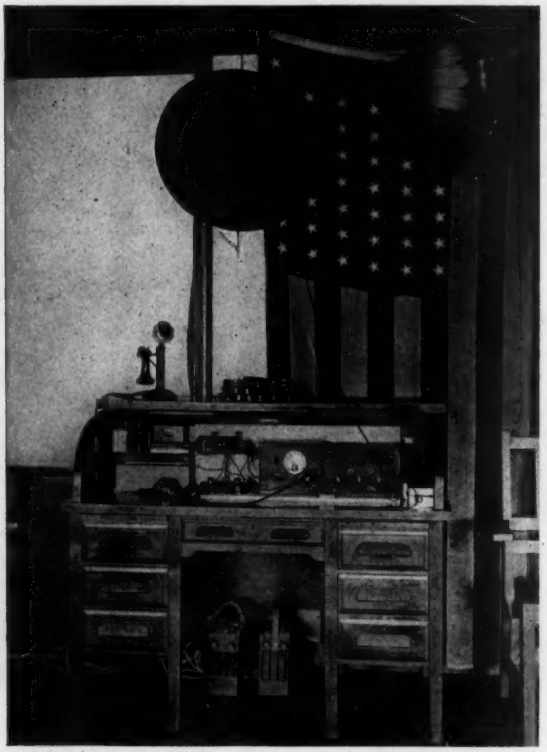
G. R. Herbert of the Bronx was so enthusiastic over the voice broadcasting that he had the copy he made of the fight description framed and hung on the wall of his radio station.

At Frankfort, Philadelphia, S. J. Thackery, using a 2-step amplifier and regular phonograph horn, found the

voice easily audible 100 feet from the receiving set. Fifty persons listened to the voice broadcasting at his station.

F. S. Gostenhofer of New York writes as follows: "While I am one of the many thousands of 'rank outsiders' in wireless who listens in to what the World is saying, doing no sending, I nevertheless feel that I owe you many thanks for the very able manner in which the voice broadcasting of the several fights today, including that between Dempsey and Carpentier was handled. Several people here enjoyed the fights as they progressed. You have not only rendered a great public service but demonstrated once again the remarkable possibilities of the radiophone both at present and for the future."

The S. S. "Delambro" (at dock at Brooklyn, N. Y.), reports through her operator the use of a Marconi crystal



A receiving station typical of those used by amateurs who organized their own entertainments is this one, which made the voice audible to 500 persons who packed two floors of the First Ward Hose Company of Morristown, N. J.

receiver. The voice was by far the best he had ever heard on that type of receiver, and entertained the officers of the vessel and the crew.

Charles Winters writes that his son, Peter, fifteen years old, has erected a home-made wireless outfit in the back yard of his house at Hackensack, N. J. He states that the boy constructed the whole apparatus out of waste wood and pieces of wire and that if we had an opportunity to look the outfit over we would probably laugh. On the night of July 1st he ran in to his father and exclaimed: "'Father, I hear somebody speaking!' At first I did not believe him, but was easily convinced as I heard the voice myself. Needless to say the young man was greatly excited. We enjoyed the speech and music very much and it was as distinct as if it were in the same room." He further says that when the amateurish, incomplete wireless outfit of a school boy could receive these messages so distinctly it certainly seems to open up an immense future possibility for the radiophone.

From Chatham, N. J., Edwin Westervelt reports fourteen guests, voice clear, modulation perfect and better than the voice from any radiophone station ever before listened to.

At Peekskill, N. Y., F. Lesh Williams had several guests who heard the entire voice description clearly on a crystal detector.

At the home of Lawrence A. Wood, Peekskill, N. Y., thirteen people listened to the radiophone reports of the events at Jersey City. Hopes to hear the radiophone again soon.

From Schenectady, N. Y., Walter N. Sorgens reports the voice loud and clear; four persons listened to the broadcasting.

Conrad F. Bond congratulates the N. A. W. A. on the audibility of the radiophone description. He lives a mile outside the village of Collegeville but quite a few persons walked the mile in order to get the radiophone reports. Everybody was surprised and delighted at the clearness of the voice which was received on a loose coupler, fixed condenser, Murdock phones and a galena detector.

At Roselle, N. J., James M. Scott heard the voice very distinct and did not miss a word. His house became crowded and a number of persons found places on the porch and on the lawn. Bulletins were broadcasted to those outside the house by means of a megaphone.

Roy R. Neira of New York City intended to receive the broadcasting, but his set went bad, so he rushed over to a friend's house in order to get the returns. He found the friend's house crowded and had to wait in the hall with a number of others while the results were retransmitted by means of a small megaphone.

George W. Morgenroth states his was the first station in Harrison, N. J., to get the result of the big fight outdoors to the public, and he carried the idea further by hastily making signs announcing the result and tacking them up about town. He added a line at the bottom of these signs: "Through the courtesy of the National Amateur Wireless Association."

Charles E. Coyle, member of Engine Company No. 60, East 137th Street, New York City, entertained an audience consisting of members of the company and friends, about twenty-five in all, who proclaimed the demonstration the most wonderful and novel method ever known of broadcasting the result of a boxing match.

At East Orange, N. J., says Charles Porter, Jr., the broadcasting of the events was all that could be desired. It was very realistic and everybody was excited at the finish.

At Passaic, N. J., the Economy Electric Company entertained ten persons in its office.

Werner Electric Company of Ridgewood, N. Y., had its store jammed to the doors with listeners to the voice broadcast which was easily audible all over the place.

At Montclair, N. J., Eugene Richter had eight people listening. He reports the voice very strong and clear and says: "Never did I dream I could do such a thing! Radiophone! 1600 meters! Eight people getting it all. I wish I could have had 1800 people instead of eight enjoying it. We were all completely thrilled."

E. F. Stearns of Brooklyn received the broadcasting using a small chunk of tin roof for an aerial; he states that the description was absolutely perfect.

From Trenton, N. J., F. W. Sutter reports that the voice transmission was heard clearly and distinctly with one vacuum tube; three head sets were connected in series and six persons listened.

W. H. Clark of Morristown, N. J., says the radiophone was clear and distinct. Twenty persons listened.

Edwin J. Dunn packed a small set in a valise and went to Maspeth, L. I., where a wire was attached to a tree in a field. The entire broadcasting was clearly heard.

At Rochelle Park, N. J., Stewart Becker had eighteen phones attached to two Baldwin head telephones and ten

guests listened to the reception. Several officials of the Standard Oil Company, White Oil Company and Western Electric Company were present. He states that no clearer speech was ever produced by land telephone. In the same town, the Union County Radio Association had a number of guests who were entertained by a perfect reception of the voice. A written transcript of the description of each bout was made, round by round, and made a part of the records of the Union County Radio Association.

At Rochelle Park, N. J., Stewart Becker had eighteen friends in a room listening to the voice description. He says they enjoyed it all and had much praise for an organization which could carry out successfully such an enormous undertaking.

Carroll T. Downes made it possible for thirty-one people to listen to the returns at his home at West Medford, Mass. He kept two theatres informed as well as the ticket sellers in the North Station at Boston who passed on the information to passengers purchasing tickets.

From South River, N. J., Charles H. Dugan writes: "Through the courtesy of two young men, Fred Cost and his brother, John, I was able to receive first hand information as to the fistic encounter recently held in Jersey City. The boys were generous and permitted a good size crowd to gather in a shed at the rear of their home, while the less fortunate clung about the windows and doorway to have the tidings relayed to them by those at the instruments, using stage whispers, to pass the information along to those outside. The voice of the person at Jersey City who was sending out the news was quite as audible and distinct as one might wish for, even the clang of the gong at the ringside could be distinctly heard. One elderly woman was so wrought up as the news began coming in that she said even if she was over 70 years old she was sorry that she didn't have five dollars bet on the outcome of the fight. I'm glad she did not, as the excitement for her was a-plenty without it."

At Elmhurst, Pa., S. M. Boddington entertained twelve persons and remitted $5.00 for the good of the Cause.

At Glen Rock, N. J., Ralph Bailey attempted to receive fight returns with a detector and 2-step amplifier, but the voice was so strong as to be unpleasant with this arrangement, and he consequently reduced amplification. One of his guests employed by the "Call" at Paterson, N. J., supplied many details to his paper which the office found they were not getting through land line channels.

Joseph Haskel lives in a little apartment next to the Sixth Avenue elevated line in New York City, and here, using a home-made set, he states that the voice came as clear as if the speaker were right at his elbow. He sent in a complete copy of the entire voice broadcasting to prove it.

At Cedarhurst, L. I., C. Willis Woolford entertained several friends, who heard the voice clear and distinct on a crystal detector. His comment is: "Good, glorious, great!"

At Cartaret, N. J., the Harmony Social Club had 150 guests who listened to the voice broadcasting. The club report states that they were dumfounded at the wonderful demonstration. All agreed that it was better to hear the returns by radiophone than to go through the trouble and inconvenience of personally attending the fight itself.

Francis S. Williams reports from Hornell, N. Y., the audibility such that six persons listened at one time using only one bulb. Everybody was greatly pleased, and voted the description much superior to the ordinary methods of posting telepgraphic reports.

Ralph B. Shebbey says the voice came clear and distinct at Bristol, Pa., to five persons listening. The gong at the beginning and close of the rounds was clearly heard.

W. E. Hockman of Auburndale, Mass., arranged for the returns to be received at the Woodlawn Golf Club, the largest golf club in New England. The returns were also furnished to a gathering of neighbors which was so large that many were unable to get into the operator's house.

Salem, Ohio., proved to be one of the record-breakers, 400 miles by airline from Hoboken. Charles P. Hoyd reports that he entertained several friends and is very enthusiastic "over what amateurs have done, are doing, and will do."

Among the reports from those who supervised theatre installations is one from William F. Diehl, assigned to the Queensboro A. C., from which these extracts are taken as a specimen of the showmanship features of the program. He says: "The broadcast was received with remarkable intensity and clarity. The output was transferred to a Western Electric loud speaker which made the voice easy to undertsand in any part of the arena, which by the way seats 8,000 people. It might interest you to know that not a single interruption of the voice was noted during the entire broadcast. Every word was clear and distinct. Not one person could be discovered in the

A novel way of entertaining an audience was worked out by Harold Warren, who had a roller chair equipped and operating on the boardwalk at Asbury Park, N. J.

crowd who had ever witnessed a demonstration of radio telephony before, and one could hear a pin drop, it was so quiet during the performance."

The quotations from the foregoing are from scattered letters out of a collection of hundreds received at N. A. W. A. headquarters. They are representative, but by no means inclusive. The interest of the amateur fraternity and others has been so great that it is impossible to tell how many really listened in, for thousands of stations did not report. But as nearly as can be determined from reports on hand approximately 300,000 persons listened to the broadcasting of the preliminaries and the big fight. Perhaps the audience was larger; certainly it was not smaller.

There is one thought which runs through a large proportion of the letters received, to the effect that this method of voice broadcasting big events is something which should not be allowed to die. The idea is novel and the method has proved to be so entirely satisfactory to all listeners, even at points double the distance beyond the claimed range of the transmitter, that the National Amateur Wireless Association is being urged by hundreds of people interested in radio to continue the practice.

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A New Cathode for Vacuum Tubes

THE types of filaments now in use in vacuum tubes have some defects, principally the small exposed surface and its duration of life, which although lasting a reasonable length of time, eventually must burn out thus making the whole instrument useless.

Samuel S. Torrisi proposes a substitute for the filament cathode so constructed as to contain in its inside a heating coil to heat the cathode walls, causing them to emit electrons. The heating coil is renewable from the outside of the instrument.

Figure 1 shows the cathode in position. Figure 2 represents an enlarged form of this cathode which is made of nickel, cylindrical in shape, airtight, with a thin cap, A, also of nickel which is platinum plated both inside and outside and covered on the outside walls with an oxide to facilitate and intensify electron discharges. The cap A is coated upon the emitting portion only with platinum. That portion of the cap A, exposed to the vacuum within the tube proper, is coated with oxide. About in the middle of the cathode is an annular recessed portion having welded thereto an annulus G of platinum. Running through the whole length of this tube is a rod of mica, porcelain or any other heat resisting composition F wound on its tip with the heating coil C with leads E running down this rod to the outside of the tube making two connections at J and M.

The rod F has a covering of thin mica sheet B and N to prevent the wires of the heat coil from coming into

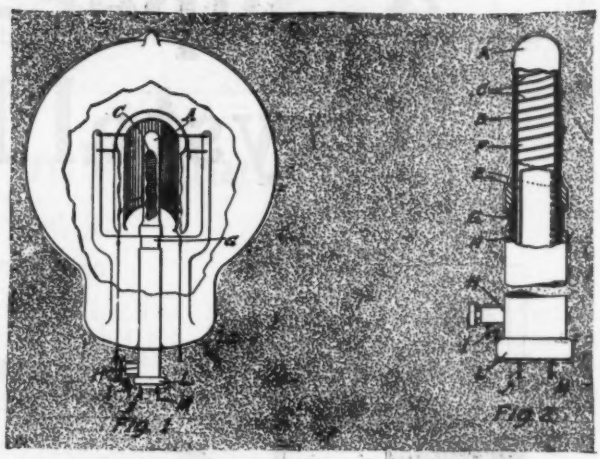

Figure 1—Cathode in position. Figure 2—Cathode in enlarged form

contact with the inner wall of the cathode A. The threaded cap L prevents the rod F from slipping out. The cathode connection I is through the binding post, soldered at H.

In figure 1, G is the lead-in while J and M are the heat coil terminals; I is a connection for the tube acting as the cathode.

A Synchronous Rotary Spark Gap

A. J. KLONECK describes an interesting synchronous rotary spark gap which is also fitted with a switching commutator permitting simultaneous transmission and reception.

In figure 1 the numerals 1 and 2 denote two disks of insulating material which carry ring shaped plates of metal, 3, 4, having a number of narrow flat projections, the disks being synchronously driven by an electric motor. Two or more stationary electrodes, 6, 7, 8 and 9, having a number of projections, serve for the discharge of high tension current to and from

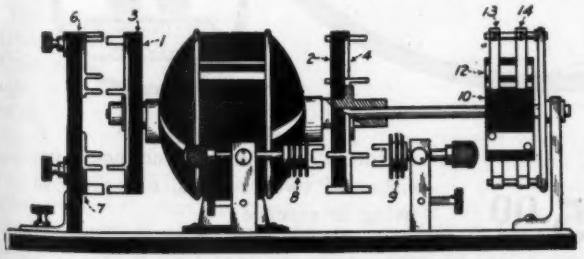

Figure 1—The synchronous rotary spark gap with switching commutator for simultaneous sending and receiving

the rotating plates, 3 and 4. A commutator 10 having a certain number of metallic segments 12, to complete electrical connection between a pair of brushes 13 and 14, is secured on the shaft and simultaneously driven with the disks 1 and 2.

Figure 2 shows a circuit for the rotary spark gap. The numerals 3 and 4 designate the two rotating spark wheels and 10 the commutator, which are synchronously driven with each other on the shaft.

It will be noted that one spark gap, 3, is in series with the source of current and the oscillation transformer, while the other spark gap, 4, is bridged across this circuit. The purpose of this arrangement is that the oscillation transformer, antenna and ground is first charged with current through the gap 3, whereupon the circuit is interrupted and the transformer discharged through the spark gap 4. Another interval of rotation of the wheels will elapse, whereupon the segments of the commutator will connect the transformer to other apparatus, as for instance, to the receiving instruments. For this purpose, the transformer will have additional connections to the receiving apparatus, as for instance through an induction transformer L,

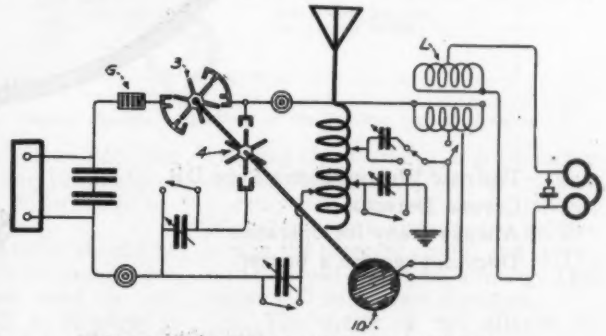

Figure 2—Circuit for the rotary spark gap

the circuit to this being closed through the segments of the commutator and its brushes.

It has been explained that the transformer was once charged and discharged before it changed to receiving. However, the spark gaps 3 and 4 may charge and discharge the transformer several times regardless of any time period between two charges of the receiving instruments.

For the purpose of reducing the spark length between the rotating electrodes a quenched spark gap G is connected in series with the rotating gaps.

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EXPERIMENTERS' WORLD

Views of readers on subjects and specific problems they would like to have discussed in this department will be appreciated by the Editor

Filament Protection in Vacuum Tubes

By W. J. O'Neill, Jr.

FIRST PRIZE $10.00

THERE are at present no reliable methods to protect the filament of a vacuum tube other than fuses and relays. Fuses are inaccurate in current carrying capacity, are expensive, don't offer adequate protection against current surges, etc., and at present are adaptable only to one-ampere filaments. Therefore, the following method is a special relay system. It is adaptable to any kind of tube, works on any other circuit. It consists of a meter in the filament circuit of the tube. It may be a D. C., A. C. or hot wire meter, the last being preferable since it measures D. C. or A. C.

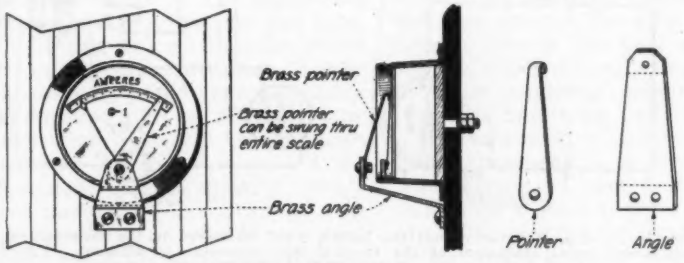


Figure 1—Constructional details of the filament cut-off

The meter is mounted on a panel or board. A piece of brass is cut in the shape shown below. Two holes in one end are for screws to fasten it to the mounting. The other hole is bored to fit a bolt which clamps a brass pointed to it so that it turns stiffly. The pivot is directly above the bearing on the meter. The brass pointer is then cut and attached so that it runs over the scale of the meter the same as the ammeter hand, except that it is higher and the point touches the meter needle at the tip if swung around. The glass on the meter is removed. At the point where the pointers come in contact, a place is filed so that the current passes from one pointer to the other.

The brass pointer can be swung over the scale freely and is set at the position giving the maximum number of amperes that is desired to run through the filament and then setting the brass hand so that the meter needle will come into contact with it if it goes farther up the scale.

Since about one ampere is consumed by the bulbs commonly used by amateurs and since one ampere would heat the hairspring on the meter a polarized relay is necessary. The armature on a polarized relay rotary is in a down position whether the current is turned off or not. The hookup is shown using the filament battery as a source of power to operate the relay circuit.

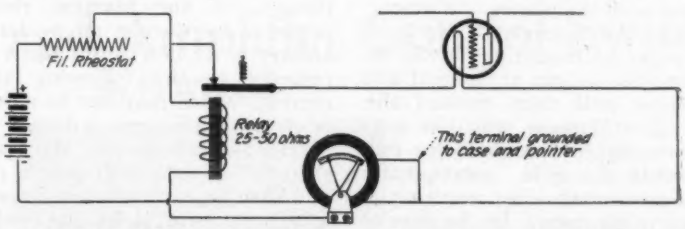


Figure 2—Circuit diagram showing connections of the filament protective device

A high resistance relay should be used so that it will not consume too much current when used on six volts. A relay of 25 to 50 ohms is good, as this draws ⅛ to ¼ ampere, which is not too much for the meter spring and bearings.

The device is connected as shown in figure 2. The meter frame should be connected to one binding post of the meter. The grounded terminal is taken from one of the screws which hold the meter to the panel.

The operation is as follows: Say, for example, the brass pointer is set at .8 ampere. The bulb is turned on and the operator decreases the resistance of the rheostat. Current flows from the filament battery, through the rheostat, the relay contacts to the bulb and back through the ammeter. But if the resistance of the rheostat is lowered more current flows, more than .8 ampere so the meter needle ascends the scale until it touches the brass pointer. This closes the circuit between the relay and the battery and current flows through the rheostat and relay. The relay is opened and since it is polarized the contacts remain open, cutting off the filament current. In order to light the bulb again the rheostat is turned down and the relay armature reset.

The advantages of this device are:

1. Reliable method of cutting off filament current at any vacuum tube.
2. Comparatively low cost considering the saving. A good meter can be obtained for five dollars, and a relay for two or three dollars. Many amateurs already use ammeters in the filament circuit and therefore this will cost them nothing. The meter will serve two purposes.
3. The meter is not altered in any way. It can be used for other things also.
4. This device can be adapted to any receiving, amplifying or power tube or any other circuit requiring an automatic cut-off.
5. Any amperage can be selected by previously setting the pointer and it will work above the normal range of the meter by shunting it with resistance wire.

Methods of Prolonging the Life of Vacuum Tubes

By L. R. Felder

SECOND PRIZE $5.00

NO amateur likes to dig down in his pocket every now and then when one of his vacuum tubes goes up in smoke. The amateur fraternity will therefore be thankful to THE WIRELESS AGE for having chosen the above subject for its prize contest, as no doubt methods will be described which will help them to prolong the life of their tubes.

One of the common dangers to minimize is that of the grid falling towards the plate or the filament falling towards the grid. This has been observed to be a very frequent occurrence, not only with weakly built tubes, but the strongest power tubes. The hot filament falls towards the grid and not only burns the grid, but may also cause damage in the radio frequency circuit. Or because of the very strong electric field produced by the plate voltage the grid is pulled over to the plate with similar damage. By mounting the tubes properly these effects can be greatly reduced. At the start I used to mount the tubes in my set as follows: The tubes with straight filament, spiral grid and cylindrical plate used to be mounted horizontally, and tubes designed like the Western Electric J tubes were mounted with the planes of filament, grid and plate horizontal. In both these types of mounting it will be seen that the weight of filament and grid helps pull them toward the plate. The filament when lit sags and naturally the weight helps pull it towards the grid, consequently trouble is sure to arise resulting in damage to the tube. In the case of the cylindrical plate tube the remedy was to mount the tube vertically, and in the case of the J tubes to change the method of mounting so that the planes of filament, grid and plate were vertical. Considerable improvement was noted with this arrangement.

In my opinion the commonest cause of life reduction of tubes is the burning out of the filament, and this is invariably due to too much current in the filament circuit. This excessive current in the filament has been traced to two sources, high filament current caused by too little resistance in the filament rheostat and excessive plate current adding on to the filament current.

The amateur works his receiving or transmitting set, and when finished he opens his various switches and leaves the different adjustments in position. At some later time he comes back to work the set again, throws on the switches — the filament suddenly lights up and just as suddenly goes out—burned by too much juice. The setting of the filament rheostat last time was all right, but between the last time and now the storage battery has had a chance to recover, the rheostat is cold now and has a lower resistance and likewise the filament. This tends to increase the current through the filament enough to cause fatal damage to the tube. Of course, it is easy to say that when the switches are thrown off the filament rheostat ought to be thrown all in, but the answer is we don't do it—so I have resorted to the following simple remedy, which may not be new, but is certainly effective. I do not use a filament switch proper. My filament rheostat is of the well-known porcelain base type, circular in shape, and when the arm is at the end and throws all the resistance in, it also disconnects from the rheostat wire and thus opens the filament circuit, in this way acting as a switch. This is clear from figure 1. So that in order to open the filament circuit it is first necessary to introduce all the filament resistance in the circuit. Thus when you start the set again all the resistance is in and the current a minimum, which can be increased to the right value by decreasing the filament resistance. I can state that with this precaution I have never had a filament burn out due to excessive current.

The second cause for too high filament current is sometimes due to a high plate current adding on to the filament current. It is well know that the plate current flows through one leg of the filament and thus increases the filament current. The normal filament current may be adjusted so that this increase is not dangerous. But when a transmitting tube stops oscillating for some reason the plate current jumps to a high value and thus frequently causes a burn-out. No definite rules can be given for the prevention of tubes from stopping oscillating. The only remedy here is to have some device which will open the plate circuit when the plate current exceeds a given maximum. For this purpose I use small fuses in series with the plate leads. In general the danger here discussed does not take place with receiving tubes and low-power transmitting tubes, as the plate current is very small, but on the higher power tubes this precaution must be taken. However, a fuse takes a certain length of time to operate and sometimes if the excess current is great the filament burns out before the fuse has a chance to operate. What is required is an instantaneous breaker which will open the plate circuit as soon as the excess current begins to flow. The writer has seen such a breaker, very simple in construction, used in some experimental work.

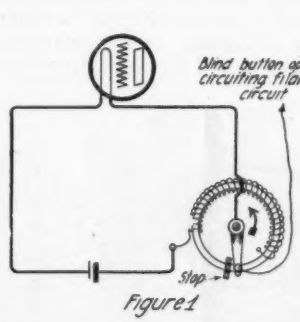


Figure 1

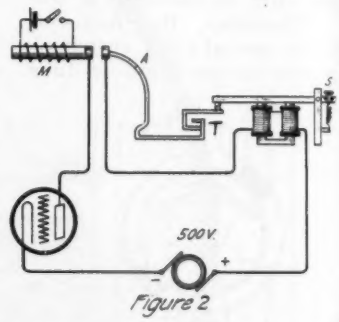


Figure 2

Figure 1—To close filament circuit the handle must be moved in the direction of the arrow which inserts total resistance of the rheostat and protects the filament. Figure 2—Plate current circuit breaker

The principle of this breaker is seen in figure 2. It consists of an ordinary landline telegraph sounder operating in conjunction with an electromagnet. The electromagnet M is excited by one or two dry cells. The breaker arm A is sufficiently far from the core of M to prevent it being attracted, but when placed in contact is held attracted. When so attracted it is locked in position by a trigger T. The armature of the sounder is placed above this trigger device. The plate current of the valve flows through the sounder magnets and through the circuit

breaker contacts. By means of the spring and screw S the armature can be so adjusted that it will be attracted by any current as small as you please. When this current is reached the armature of the sounder is pulled down, hits the trigger device and releases the breaker arm, thus opening the plate circuit. This device will act instantaneously, and with such a breaker you can be sure of preventing any excess plate current. By adjusting the tension screw S you can adjust for any plate current. The action is positive and will never fail.

With these devices installed and precautions observed, there is no reason why the normal life of a vacuum tube should not be secured. If not observed renewals often too frequent are sure to result with large expense involved.

Unexplained Phenomena of Vacuum Tubes

By W. G. Hunt

THIRD PRIZE $3.00

I HAVE two vacuum tubes which have been in continual use since February, 1913, except for the period 1917-1918—during the ban on amateur wireless. Their long life has been due to care in handling, and a protective device in the shape of a stop placed in the filament rheostat assuring a voltage of not over four.

Greatly improved operation of the tubes has been secured as a result of a suggestion made by a friend who could give no explanation for the phenomena noted. The suggestion was, in effect, to subject the tube, to a heating process in order to secure increased sensitiveness. A tube that formerly acted very unsteadily and required a lot of "B" battery by this heating treatment became more sensitive. I decided to extend the experiment and regularly every three months I placed this tube in a soup-ladle—one which was perforated much the same as a colander —and placed it over a hot coal fire, raised and lowered the ladle, tube and all, first heating it so that it would just sizzle when the moistened finger tips would touch it, and keeping it at this temperature for ten or fifteen minutes. Upon being replaced in the panel and turning on the B Battery, the tube would "blue" at a much lower voltage. This has always worked out. I am now trying the same stunt with another tube, and while marked improvement in its operating characteristics has been noticed, the tube has only been in use for one year and three months, which is hardly time enough to claim anything definite except that it is improving daily.

The tube used in connection with this experiment is a wonder for sensitiveness. I have heard all the transatlantic stations that our friend Mr. Al Groves has reported—thanks to his useful hints in manipulating the honeycomb coils—and in addition, can hear BUC Bucharest, and PRG, Prague, any favorable evening after seven-thirty P. M.

I believe that by heating the tube some chemical action takes place within it and a gaseous content is formed which reduces the vacuum and renders the tube more sensitive. In other words I believe that a tube which ordinarily gets hard with the continual use of the high voltage battery, is so acted upon by careful heating that it is rendered normal again, and I am satisfied that this experiment tried upon two tubes out of an original dozen has lengthened the life of the tube by aiding the flow of electrons in some manner not yet explained to me by anyone.

Rubber cushions are used under mountings, and small fuses also protect the filament input, so that the present panel in use is practically fool-proof.

V. T. Detectors and Amplifier Control Switches

By E. W. Lehr

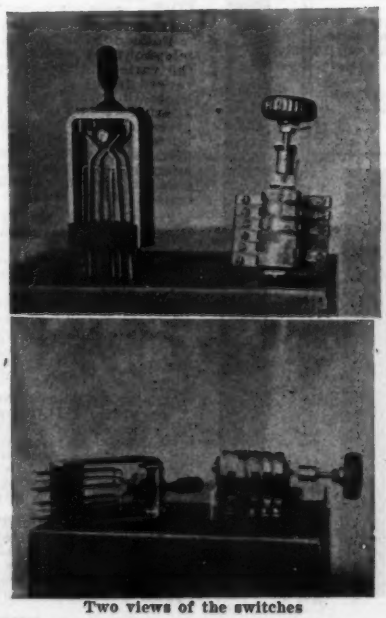
THE subject of control switches for vacuum tube detectors and amplifiers has been somewhat neglected and the amateurs as well as the manufacturers have hardly given the matter a thought.

For the benefit of those interested I will try to show the value and convenience of such switches. The usual amplifier controls are jacks and plugs, the operation of which is slow. The plug has to be shifted on each step, and in some cases filaments turned on.

Figure 1 shows a two-step amplifier with the usual arrangement of jacks.

Figure 2 is a rotary control switch, which controls the phones on the plates, as well as the filament on each step. This switch is not difficult to make and for the benefit of those wishing to construct one, the following details will be of service:

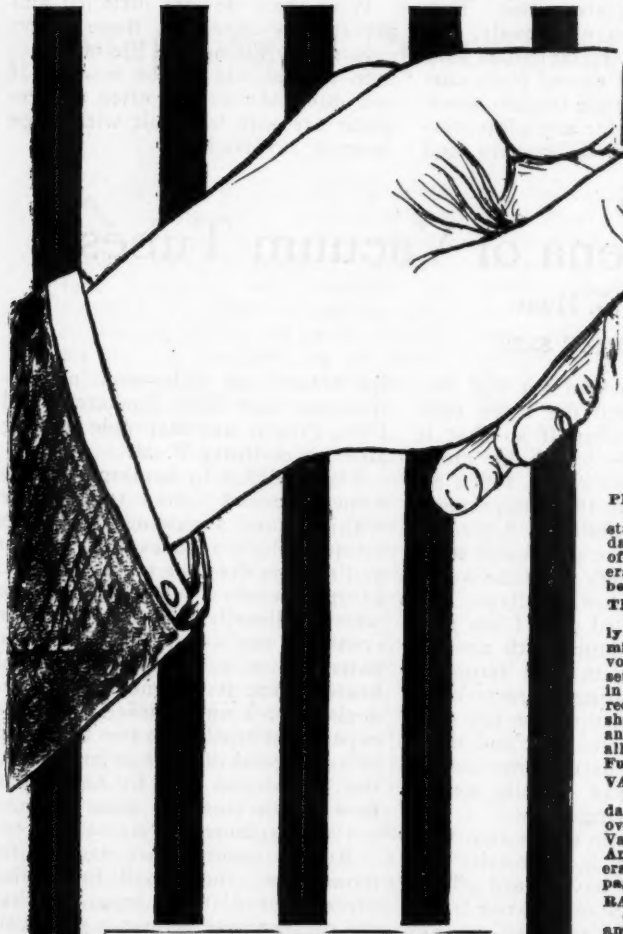
The rotor is made of a piece of round fibre ¾ inches in diameter and 1½ inches long. A screw is tapped in each end to serve as a shaft, one end long enough to go through the panel so as to fasten on a knob and pointer. A base is made of ¼ x 1½ x 1½ inch bakelite on which the bearings and contact fingers are mounted.



Two views of the switches

The control switch segments are made from thirty-second copper sheet cut to shape and bent to fit the round figure snugly. Small holes are drilled in the segments and fibre to a depth of three-sixteenths of an inch and small pins are driven in. Counter sink the holes in the copper so that after the pins are driven in a drop of solder will seal them and the rotor can then be smoothed off and polished. The contact fingers are spring brass or phosphor bronze and are bent at right angles and fastened on the base with very small screws or pins so they will not turn out of place. Care should be taken to line the fingers with the rotating segments for each step as shown in figure 4.

When the pointer on front of the panel comes on the first line the



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vacuum tube filament is lighted and the phones are connected in position. When on No. 2 the filament of the first step amplifier is lighted and the phones are connected in the amplifier circuit. Turning the control handle back to O switches all filaments and plates out of the circuit.

Figure 3 shows a simple circuit using an anti-capacity switch or cam switch, as the telephone people call them, and can be bought at any supply house. It has twelve blades, six on each side. When the lever handle is in the up position the phones are connected to the detector; when in the center the phones are connected to the one-step amplifier; when in the down position the second-step amplifier is connected. In this diagram no provision has been made to operate the filament, but extra contacts could very easily be attached. In another article, at a future date, I will endeavor to give a receiver circuit without a feed back using this cam switch which seems to be the thing for C.W. and phone work.

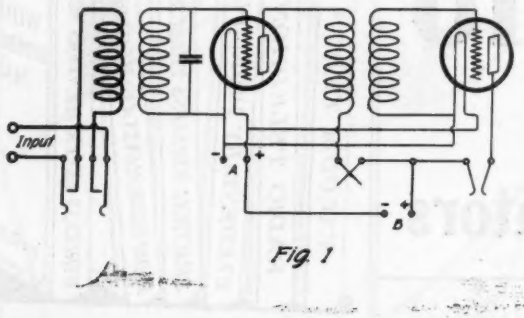
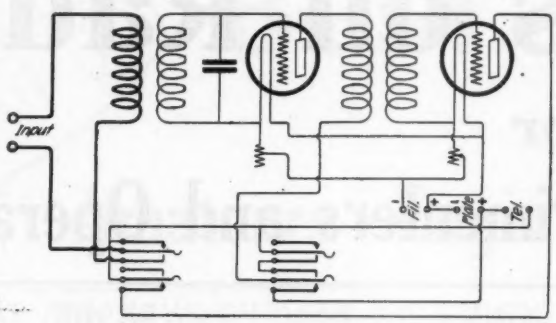


Fig. 1



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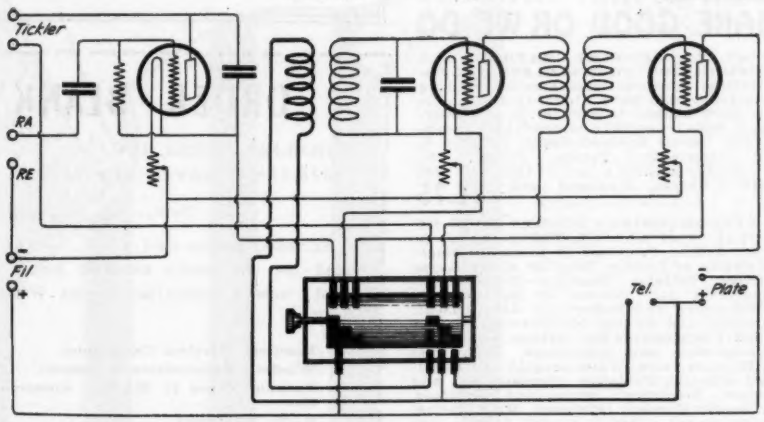

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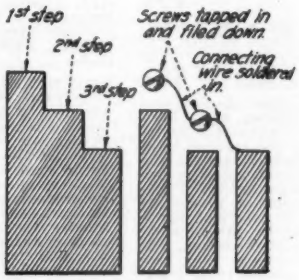


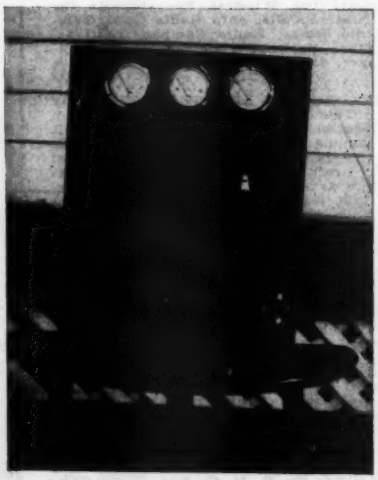
Fig. 4

Circuit diagrams showing usual hookup of jacks, cam switch and rotary switch with details of the latter

20-Watt C.W. Set at 5ZA

ONE night last February, while tuning for CW sigs, Mr. Louis Falconi, owner of Radio Station 5ZA at Roswell, N. Mex., was surprised to hear 5XB calling 2ZL and then actually answer 2ZL. Upon further tuning 2ZL was picked up. 5XB stated that he was using 3 five-watt tubes. The distance to 2ZL is over 1500 miles and the fact that such a distance could be bridged by 15 watts CW made the writer wonder what a good CW set would do. This incident thoroughly implanted the germs of CW in 5ZA and as a result the 20-watt set shown in the accompanying photos was hurriedly put together. The results are surely wonderful.

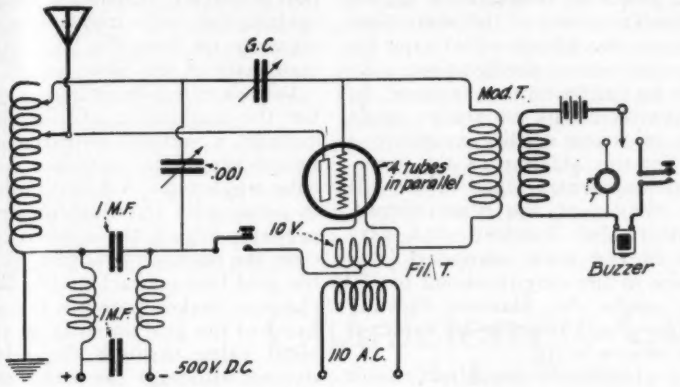
The circuit used is a modified Hartley affair and gives good results. Other circuits were tried but probably due to some wrong constant in aerial system none could be induced to oscillate. Maximum radiation is obtained on 280 meters.



Front view of the 20-watt C. W. set

The inductance is wound on a 4-inch tube 7 turns to the inch with 80 turns of No. 10 bare copper wire. Pieces of the same wire ½-inch long are soldered to every other turn for taps and connection made by means of clips. The inductance is shown in two parts but both parts make up the one coil. The condenser across the inductance is a .001 mfd. double spaced variable. The grid condenser is a Parkin variable and it fills the bill nicely. The grid leak is a variable 10,000 ohm unit. For CW only the secondary of the modulation transformer is used as a leak. About 2500 ohms is correct for 4 tubes. The filaments of the tubes are lighted by a step down transformer and all tubes are controlled by one rheostat. The lighting transformer has a secondary voltage of 10 and a tap is brought out from the center of this winding. Three meters are used,

aerial ammeter, plate milliammeter and filament ammeter or voltmeter. The filter circuit is made up of the usual condensers and inductances. A 200-watt motor-generator set giving 500 volts, is used for high voltage.



Circuit diagram of the C. W. set installed at 5ZA

Referring to front view of set from left to right, the meters are aerial ammeter, 3 amperes; plate milliammeter, 500 milliamperes; filament ammeter, 5 amperes. The center knob controls the grid condenser and the lower left hand knob controls the variable across inductance, while the right hand knob is the rheostat. The three-point switch changes from CW to telephone and to buzzer modulation. Binding posts are for the transmitter and the key.

Referring to back view of set, the tubes are mounted on a shelf as shown and all connections to the source of power are made to a small panel under the tubes. The filter is mounted in back of the connection panel. The whole set is mounted on a hardwood base board. CW transmission is accomplished by breaking the negative lead from the high voltage source. Using that method, the tubes may be overloaded and no great heating will result since the tubes work only when the key is down.

On CW, with tubes somewhat overloaded, the radiation is 2.75 amps. With buzzer modulation it was found that more grid resistance was required and the radiation is 1.75, and for telephone the radiation is only 1.5, it being useless to increase the power as only that much can be modulated by present arrangement.

As to results, the following stations have been worked, 9XM, 9RY, 7ZG, 6EN, 6ZN, 6ZH, 6ZZ, 5ZL, and others on C. W. 'Phone has been heard by 6ZZ, 5HL, 5YH, 9WI but not very clear. Buzzer reported very QSA by 5ZU, 5ZL, 6ZZ, 7ZG, 9OE and 6ZH. Lately a card was received from the S. S. WSR running from Astoria, Wash., to Chignik, Alaska, and the operator reports CW signals 1000 miles west of Astoria or 2300 miles from 5ZA. These results were obtained during bad QRN as the set was not finished until bad weather commenced. If this set—now increased to 6 tubes—proves its worth next fall, 5ZA's spark set will make way for a higher powered tube set.

Back view of the set showing the location of the various elements

Filament and Plate Current from a Single Source for C.W. Work

By John F. Bront

IN the low-powered CW transmitter one of the chief sources of concern has been the high cost of a necessary medium for the application of a high-plate potential. To resort to the purchase of a motor generator delivering 500 volts to the tertiary circuit imposes a burden upon the purse of the average experimenter. The adaptation of the standard high potential dry cell to plate batteries makes a wasteful and prohibitively costly affair if transmission is to be carried on over a period of time. Secondary cells for plate potentials, in most cases, are out of the question.

In this article I will try to suggest a method of obtaining a high-plate potential and also adapt the single source of power to light the filament and charge the plate of the transmitting tube. Although the present market does not seem to offer a method of furnishing both plate and filament current from a single source, the accompanying sketch shows a possible way of doing it. A successful operation of a similar device would greatly interest the average experimenter and prove both economical and practical for employment in the small CW transmitter.

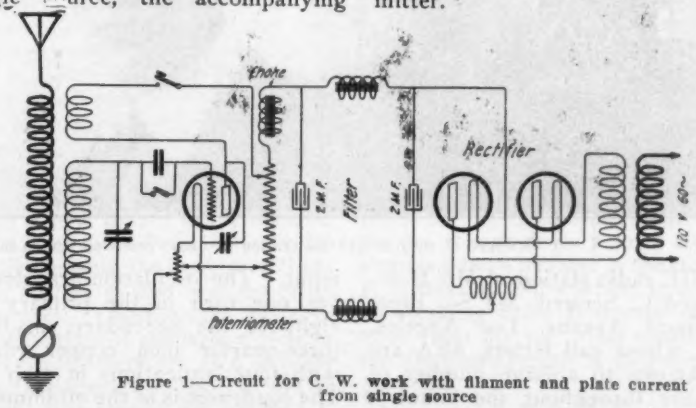


Figure 1—Circuit for C. W. work with filament and plate current from single source

Referring to the sketch, the primary takes commercial current at 60 cycles. Current for lighting the filament is obtained through the

agency of the smaller secondary which may be wound in suitable ratio, depending on the type of rectifying tube employed, and the applicable current to the filament, to execute the rectification of the A.C. supply.

The main secondary feeds pulses of direct current through the plate-filament path of either rectifying tube, alternating with the reversals of the induced e.m.f., supplying unidirectional current to the filter circuit, the plate, and across the terminals of the potentiometer resistance. With the connections of the rectifier, shown here, the current moves in a direction which is counter-clockwise. The rectifier is of the type that is familiar and popular with experimenters. For the information of readers not familiar with the details of construction of this type of rectifier, the following may be of interest: The rectifier transformer is of the core type and the core approximates the dimensions of 6 in. x 4¼ in. x 1¼ in. (latter is cross section). The total amount of iron required for the core consists of about 6 to 7 pounds of stovepipe iron, gauge 26. Four hundred turns of No. 20 D.C.C. makes up the main primary winding. With an intervening tube of thin micarta or dilecto, the filament lighting winding consists of about 90 turns of No. 14 B&S copper D.C.C. Insulated from the latter is the main secondary, which consists of a winding preferably made up in sections that allows of no potential breakdowns across the insulation and at the same time facilitates the taking off of taps for the graduation of the required voltage to be employed on the plate. At least two sections should be made so as to make readily available a place for the placing of the intermediate tap which leads to the left hand choke of the filter circuit. About twelve hundred and fifty turns of the main secondary will produce in the neighborhood of 750 volts, while the filament lighting secondary will impress an e.m.f. of about twelve volts.

The chokes of the filter circuit may be made of a pound and a quarter of No. 26 D.C.C. with a suitable core of laminated or soft iron. With condensers of sufficient dielectric strength in the insulating materials the capacity may lie at either one or two microfarads. The filter will serve admirably to smooth out the fluctuations of the D.C. supply from the rectifier.

The potentiometer resistance must be steadily variable over certain ranges, depending upon the e.m.f. applied to the filament and plate of the tube or tubes employed in transmission. With the potentiometer resistance non-inductively wound no undesired inductive effects will occur. The choke in series with the potentiometer resistance serves to exclude the radio frequencies of the plate circuit from the large capacity condenser of the filter circuit.

With a variable resistance contact for the regulation of the filament voltage, a suitable adjustment may be quickly made consistent with the tube employed. A filament rheostat in series with the filament serves to properly adjust the applied current over the necessary ranges. A variable grid bias contact on the filament rheostat makes possible the adjustment of the grid potential at any desired value through the grid condenser, although the latter may be shorted out of circuit as desired. A variable condenser shunts the grid circuit and aids in fine resonance adjustments. A variable condenser in the plate circuit improves the resonance in the tertiary circuit. Proper coupling of the grid and plate circuits to the antenna should secure a maximum radiation.

A milliammeter in the antenna near the current antinode will register comparative radiation for communication.

The Radio Work of 6EA

By Thomas J. Knapp

Howard C. Seefred and his station at 6EA; receiving set on left; transmitting set on right

THE radio station of Mr. Howard C. Seefred, 343 So. Freemont Avenue, Los Angeles, Calif., whose call letters, 6EA are well known to a large number of amateurs throughout the country, is a striking example of an efficient amateur station, the apparatus of which has been homemade.

The homemade transformer of the transmitting set is one of 765 watts input. The oscillation transformer has one turn in the primary and eight in the secondary, made of three-quarter inch copper ribbon, with four laminations in each one. The condenser is of the oil-immersed type, consisting of seven window glass plates, twelve by fourteen inches and one-eighth inch in thickness with the tinfoil area over eight by ten inches, leaving a two-inch margin. The rotary gap is a hard rubber disc, six inches in diameter and half an inch in thickness, with sixteen copper studs evenly spaced on the shaft of a 1700 R.P.M. induction motor. The antenna current, with a thermo-couple ammeter, is four and one-quarter amperes.

The regenerative receiver set is of the variometer type, designed somewhat after the famous "Paragon

RA6." One step of amplification is used. Signals from Fifth and Seventh District stations have been copied at times when atmospheric conditions were good. Real long-distance reception has been made impossible owing to interference from leakage on high voltage lines nearby, and also from nearby naval stations. The well-known "Type E" Baldwin phones are used.

The antenna, which is of the inverted "L" type, is composed of four copper wires, seven strands of number twenty-two, on fifteen-foot spreaders; the height is forty-five and fifty-two feet on sloping ground, and the length forty-five feet, with a fifty-one-foot lead-in, making a total of ninety-six feet to the oscillation transformer.

The ground system is composed of four galvanized iron wires, six strands of No. 9, seventy feet long and forty feet wide, directly beneath the antenna. Besides this, there are ten strands of No. 18 copper wire running from the station across the yard and connected to a wire fencing partly around the place, and also connected to the water pipe and metal plates in the ground.

During the recent winter this station has established communication with 5ZA at Roswell, New Mexico, and 7CC at Moscow, Idaho, and was reported heard as far west as Honolulu, Hawaii, and by 9ME at Fort Wayne, Ind., to the east. Relay traffic has been handled regularly with Fifth and Seventh District stations and, of course, with many Sixth stations at a distance. Signals from this station have been reported heard by 2KF (Irvington, N. J.); WWV (Washington, D. C.); 8AIB (Dayton, Ohio); 5XA (Auburn, Alabama), and by the WOG anchored at Reid Island, Canada. The station has been reported as having been heard in twenty-five states and five territories.

Characteristic Curves

By Jesse Marsten

THE use of "characteristic curves" has become so frequent and important in explaining various electrical phenomena and electrical devices, as for instance the vacuum tube in radio work, that a discussion of "characteristics" in general with some practical applications may not be amiss.

A "characteristic curve" may be taken of any electrical conductor, device or machine, and may be defined specifically as the curve showing the relationship between the current through the device and the voltage across its terminals, as either one is varied. It is this curve which enables us to explain the operation of so many electrical devices and which is so extremely helpful in electrical designing.

It is best to begin the study of "characteristics" with that of the simplest kind, namely the characteristic of a metallic conductor. This characteristic is obtained by varying the voltage across the terminals of the conductor and measuring the corresponding currents through it. A curve is then plotted of voltage against current and a characteristic as in figure 1 is obtained.

This curve is characteristic of all metallic conductors and is called, because of its upward slope throughout the range of the graph, a "straight line rising characteristic." It has constant slope, that is the quotient of voltage by current at any point, is constant.

$$\frac{e}{i} = \text{constant} = R$$

which constant is the resistance of the conductor. The above expression of the relationship between voltage and current is the "equation of the characteristic" and as will be recognized is the well known Ohm's law. The slope of the curve is positive, and changes in magnitude or sign results in a like change in the other variable.

Now these are well known facts about metallic conductors. But all conductors do not have such simple characteristics, nor do they all obey Ohm's law. Consider two types of electric wave detectors, crystal and electrolytic. Characteristic curves of both these types will appear as in figures 2a and 2b, crystal and electrolytic curve respectively. The upper quadrant is obtained by applying the voltage in one direction, the lower quadrant by applying it in the opposite direction.

An inspection of figure 2a will show that the crystal does not permit current to pass through it equally in both directions, but suppresses the current in one direction. Consequently if an alternating current is applied to the crystal as shown in the figure, one-half of the current wave is suppressed, due to the unilateral conductivity of the crystal as indicated by the characteristic curve. The crystal therefore acts as a rectifier, which is the basis of the explanation of the detecting action of the crystal.

Figure 2b of the electrolytic detector shows that both halves of the characteristic are identical, and that current passes in one direction exactly as in the other direction. However it will be observed that over a definite range of voltage the current through the detector is zero. Consequently if a biasing voltage is applied to the detector, of value E, and an alternating voltage is now applied to the detector, one-half of the voltage wave is inoperative because the detector will not permit current to pass over the range of voltages. Consequently the electrolytic detector is similarly a rectifier and is useful therefore as a detector of electromagnetic waves. It will be observed that beyond the value of E volts, the electrolytic detector behaves exactly as a metallic conductor and has a rising straight line characteristic.

The microphone contact presents an interesting study of the subject in hand, when various pressures of contact are used. If a series of curves are drawn showing the variation of current with voltage at different contact pressures they will appear as in figure 3. The upper curves are those taken with low pressure contact, the lower curves are those taken with high pressure contacts. The curves show that high pressure contact on microphones results in lowering the resistance of the microphone virtually, and increasing the current through them. This increased current naturally results in excessive heating of the microphone, and in the case of the carbon transmitter increased heating of the carbon granules, which explains the "caking" of microphone transmitters.

Let us pass for the time being to a very interesting conductor and electric device, namely the arc. The arc may be considered as a gaseous conductor, formed by incandescent vaporized carbon. If corresponding values of voltage and current are measured and plotted a characteristic curve is obtained as in figure 4. It will be seen immediately that this characteristic is essentially different, from any discussed so far. This is the first device discussed so far which has a "falling" characteristic and whose slope is negative. An increase in the current through the arc results in a decrease in the arc voltage, and as a result the arc is unstable. For when the arc voltage drops a small amount there is a large increase in the current. It is this instability which is utilized in obtaining radio frequency oscillations from the arc. The equation of the arc characteristic is in general of the form.

$$E = \frac{b}{I} + a$$

where a and b are constants depending on the arc electrodes, length of the arc, etc.

An interesting practical application of the use of the straight line characteristic of metallic conductors in conjunction with the falling characteristic of the arc is the following. When the load on a generator is an arc lamp, the generator is always in danger of being damaged due to excessive current flowing through the arc. For from the falling characteristic in figure 4 a small drop in voltage of the generator in the critical range from A to B is accompanied by a rise in current with danger to the generator. To avoid this it is necessary to stabilize the circuit and it is found that metallic resistance in series with the arc accomplishes this very purpose. Figures 5a and 5b show the characteristics of both arc and metallic resistance, when connected in series, and that the sum of the two characteristics produce the characteristic shown in figure 5b. This characteristic is unstable and falling from C to D, and stable and rising from D to E. Now in the critical range from A to B a drop in voltage no longer produces a rise in current and the generator is safe from any irregularities in voltage and current.

To pass from conductors to electric devices and machines let us examine the D. C. shunt generator characteristics. If the load, say a bank of lamps, on a D.C. shunt generator is varied and current and terminal voltage of the machine measured and plotted, a typical characteristic of the nature shown in figure 6 is obtained. This shows quite clearly that the brush voltage of a shunt generator decreases as the load increases (load resistance decreases) and consequently a shunt generator is perfectly safe against heavy loads. For from the characteristic, if the resistance of the load decreases too much (too big a load) the voltage drops to very small values and therefore the current also. In fact a shunt generator may be short circuited with no danger to the machine. From the characteristics of a shunt generator it is also possible to calculate the percentage regulation of the machine.

Lastly let us consider the characteristic of the vacuum tube, which is that essentially of gasses at low pressures. If a curve is taken of the controlling voltage against current we have the well known characteristic of figure 7. This curve is formed of three distinct parts: the curved part AB, the straight line part BC, and the curved portion or knee beyond C. If the filament emission is kept constant and the plate potential varied, and a curve drawn for each plate potential, a family of curves as per figure 8 is obtained. The slope of each of these curves in the family is the same.

Whether the tube will function best as detector or amplifier is dependent upon what portion of the curve we work. If the grid voltage is biased by a grid battery or other means such as grid condenser and leak, so that the mean grid potential is at B or C the tube will function best as a detector by rectification. For a change in the grid voltage will produce a small change in one direction and a large change in the other. Although this applies to B and C, it is not desirable to work at C, for the grid is then at a positive potential, and will absorb energy, which is very undesirable.

If the operation is around a mean point D, the tube will behave well as an amplifier. For the characteristic on either side of D is a straight line with large slope and small changes in the grid voltage produce magnified changes in plate current. The amount of amplification is dependent on the slope of the characteristic, the steeper the slope the greater the amplification. The steepness of the slope is dependent on the tube construction, the spacing of the elements, and the construction of the grid. In general it may be said that the slope is the steeper the finer the grid wires, the closer the grid wires are spaced, and the greater the ratio of plate-grid distance to grid-filament distance. Finally if the tube is a good amplifier it will also oscillate, for a portion of the amplified energy in the plate circuit may be fed back into the grid to keep the cycle going on.

Now then, in studying the characteristic curves of these conductors and devices it will be observed that the curves were obtained by varying the D.C. values of voltage or current and the results noted, and in the event of the curve occupying a negative and positive quadrant, the negative portion was obtained by reversing the battery or generator terminals. The curves thus obtained are called "static" characteristics. This is a direct current curve and the resultant current and voltage values may be read by meters.

However the controlling voltage or current may vary rapidly with time and in this case it is not possible to obtain instantaneous readings with meters. In this case it would be necessary to use an oscillograph or Braun Tube or similar device to trace the characteristic curve visually or photograph it. The curve thus obtained where both variables alter with time is called the "dynamic" characteristic.

In general the dynamic characteristic differs markedly from the static as will be seen by considering those of the arc. The general form of the dynamic characteristic of the arc is shown in figure 9. The special characteristic of the arc, when it is in commission in a radio circuit as in figure 10, is dependent on the relative values of the oscillating current through the arc and the direct current through the arc. Figures 11 and 12 show the dynamic characteristic when the direct current through the arc is greater than the maximum amplitude of the oscillating current through it, and less than the oscillating current through it, respectively.

These "dynamic" curves show that there is a lagging effect, similar to hysteresis in iron, that is, the potential corresponding to a given current is not the same when the current increases as when it decreases. The curves also show that the current does not reach its maximum at the same time that the voltage does. There is a phase difference between voltage and current. From a study of these curves the theory of the arc action may be developed.

The curves obtained in figure 8 for the vacuum tube constitute the "static" characteristic of the tube. Just as with the arc the "dynamic" characteristic of the tube depends on the external load. The most interesting case for the vacuum tube is that of maximum output, namely when the external resistance in the plate circuit equals the internal resistance of the valve. In this case the plate current for different values of the grid voltage would be one-half what they are with no external resistance in the plate circuit, in other words, one-half of the values on the "static" curves for the corresponding grid voltages. Hence the slope of the "dynamic" curve of the tube at maximum output is one-half the slope of the "static" curve for similar conditions of filament current and plate voltage. This curve is shown in figure 13. For other values of the load resistance in the plate circuit of the tube different "dynamic" curves are obtained having different slopes. The slope of the "dynamic" characteristic will always be less than that of the "static," and if R_i is the internal valve resistance and R_e is the external plate load resistance it may be said that the slope of the dynamic curve is, assuming the slope of the "static" curve to be unity

$$\text{Dynamic Slope} = \frac{R_i}{R_i + R_e}$$

There are many other uses and applications to which these characteristic curves may be put, but these will give a simple and elementary idea of the subject.

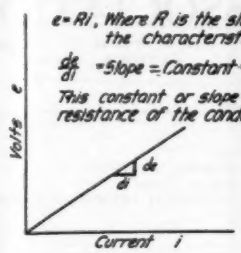

e = Ri, Where R is the slope of the characteristic
de/di = Slope = Constant = R
This constant or slope is the resistance of the conductor
Volts e
Current i

Figure 1

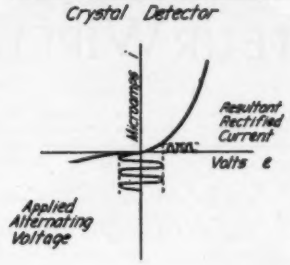


Figure 2a

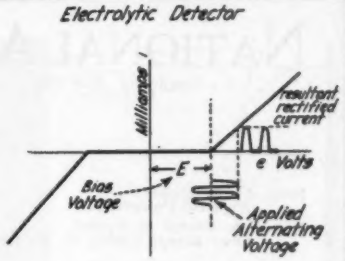


Figure 2b

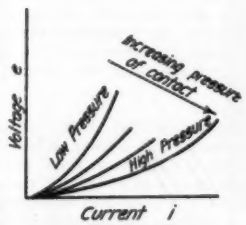


Figure 3

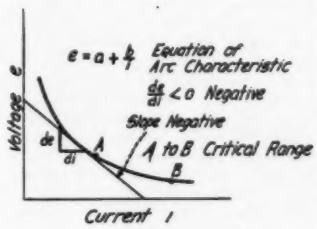


Figure 4

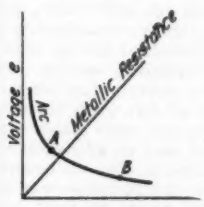


Figure 5a

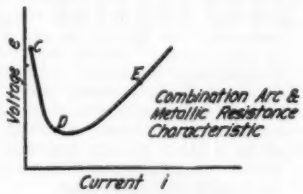


Figure 5b

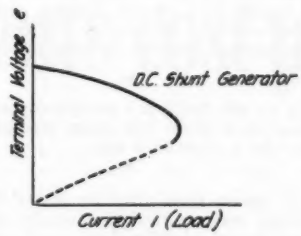


Figure 6

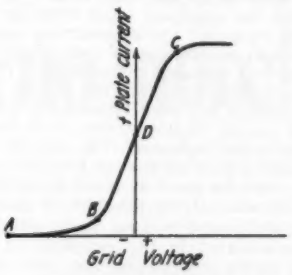


Figure 7

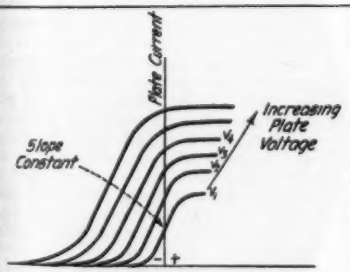


Figure 8

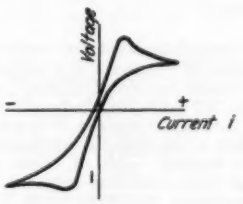


Figure 9

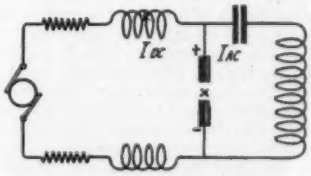


Figure 10

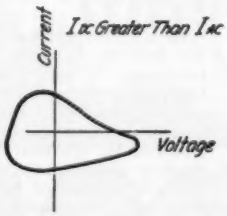


Figure 11

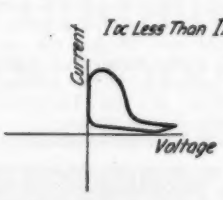


Figure 12

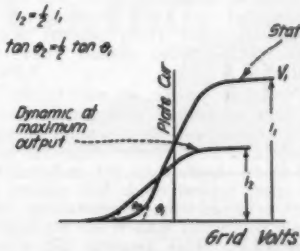


Figure 13

Characteristic curves

The MONTHLY SERVICE BULLETIN *of the*

NATIONAL AMATEUR WIRELESS ASSOCIATION

Guglielmo Marconi, *President* — J. Andrew White, *Acting President* — H. L. Welker, *Secretary*

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HEADQUARTERS: 326 BROADWAY, NEW YORK

ON July 2nd the amateurs of the eastern part of the country tackled the biggest job they have yet undertaken, and put it over. The voice broadcasting of the progress and result of the big boxing match and the preliminaries, was an undertaking of a character never before attempted, and the reception of this voice broadcasting, in theatres, halls, and other places where large audiences had paid an admission to hear it, gave the amateurs who volunteered a real job. The way the reception was handled is a lasting testimonial to their intelligence and ability. It should be remembered that the whole thing was, in a way, a gigantic experiment. Nothing of the kind had ever before been attempted and there was no precedent for guidance. Not even the dependable range of the transmitting station was known. Another great uncertainty was the hazard of electrical disturbances. For a week preceding July 2nd, the eastern part of the country had been subjected to a continuous run of thunderstorms, with heavy rain and heavy lightning. On July 1st, the air cleared somewhat and on July 2nd, conditions were as good as could possibly be hoped for considering the time of year.

Analysis of the reports from all those who participated in the reception of the voice broadcasting shows that light static prevailed throughout the afternoon over practically the entire territory covered by the transmission, except in the extreme northern sections, where the air was fairly clear. The only section where heavy static was experienced was in south New Jersey and Eastern Pennsylvania. Atlantic City reported a heavy downpour of rain accompanied by considerable lightning which seriously affected reception. This heavy static belt, however, was comparatively small and narrow. Fair to good reception was reported from all other points, which establishes the fact that the thunderstorm responsible for the heavy static was a local one.

The technical success of the broadcasting—for success it surely was, and a smashing big success at that—is a source of gratification to all interested in, or concerned with, the undertaking. The range of the transmitter under daylight conditions had been estimated to be 200 miles. As a matter of fact clear reception of the voice was reported from several points over 400 airline miles distant from the transmitter.

It is true, of course, as was to be expected, that occasional difficulty in reception was experienced by amateurs at scattered points, who, in some instances, were inclined to be skeptical of the undertaking. In one case, typical of a few others, an amateur critcised the undertaking and everybody concerned with it for attempting the impossible. This amateur did admit, finally, that he had heard the voice, though not well. From the same locality at least six other amateurs have reported that the voice was clear, loud and distinct and that reception and amplification had been accomplished to an entirely satisfactory degree.

Broadcasting by voice the greatest international sporting event in the history of the world, for the benefit of the men of our navy and the people of devastated France, was an unprecendented undertaking which called for the best that the American amateur radio operators had to give. That they did give that best, and that they did make this unprecedented scientific undertaking successful is very gratifying to all concerned. Amateur radio has earned for itself a new place in American history by making this huge undertaking a smashing, big success.

▽

One amateur located 110 miles from the Hoboken transmitter used a short metal clothesline for an antenna, hooked six pairs of phones to a crystal detector and entertained a bunch of friends. There's a chap that ought to be able to hear signals from Mars.

▽

It's a safe bet that a great many amateurs know more about 1600 meter reception than they did a short time ago.

▽

A report from Chicago stated that the carrier wave and C.W. signals of WJY were heard clearly there, but owing to static no amplification could be used and the voice could not be heard well enough through a detector alone to be understood. At that rate the voice from WJY will probably be heard in Honolulu next January.

▽

Acknowledgement is made to a great number of amateurs who were kind enough to report on the audibility of the voice from WJY on July 2nd, and to all of them the National Amateur Wireless Association wishes to express its appreciation for their kind interest. All of these reports have been read carefully with interest and the information they have given is highly valuable and will be useful in future broadcasting undertakings.

▽

It is not as yet possible to reply definitely to the hundreds of letters that have been received requesting information as to the future plans for broadcasting. All that can be told now is that the whole matter is being given careful consideration, and in the meantime WJY station, through the courtesy of the Lackawanna Railroad officials, is still intact.

▽

A certificate of participation in the radiophone broadcasting of July 2nd is ready to be mailed to C. Milanio, Brooklyn, N. Y., who failed to give his street address.

EFFECTIVE May 20 last the working wavelength of the Darien Canal Zone station of the U. S. Navy Department, was changed to 10,110 meters.

THE Department of Commerce has cancelled the station licenses and second-grade amateur licenses of a number of amateur operators who failed to appear for examination for first-grade amateur licenses when given an opportunity to do so by the Radio Inspectors of the several districts.

THE radio station of the Seamen's Church Institute, call letters KDKF located at 25 South street, New York, now maintains a continuous watch for the purpose of giving medical advice and assistance to injured or sick persons on board vessels at sea.

CONDITIONS for amateur radio work were pretty poor during late June and early July, as a succession of thunderstorms made communication difficult or impossible over practically the eastern half of the country. Continuous and heavy static was reported from the middle and western parts of the country. While the C.W. telegraph transmitters succeeded in getting through to a surprising degree, the heavy static worked havoc with the hundreds of nightly concerts by radiophone which have come to be a more or less desirable part of the affairs of amateur radio, according to the viewpoint of the listener.

THREE wireless fog signals are to be immediately installed at the entrance to New York Harbor by the Lighthouse Service. Each of these three stations is equipped with an automatic radio set sending out signals continuously during fog or thick weather. These signals may be picked up on shipboard by means of the new radio compass which indicates the directions from which the radio signals are sent out, and by taking observations on the different stations the captain of a vessel may determine his exact position without being obliged to rely on the former unsatisfactory method of determining position by the sound of whistles and fog horns.

These signals have been developed as the result of co-operative experiments by the Bureau of Standards and the Lighthouse Service, and more especially through the research work of the Bureau of Standards in improving the radio compass. This system differs from all other systems in use for determining radio direction in that the navigator himself can determine radio bearings without having to depend upon radio operators. Another advantage is that the sending apparatus is easily installed and can be operated by the regular light keepers without any skilled personnel and that any number of vessels at sea equipped with radio compasses can obtain their position at the same time without interference.

These signals have been installed on Ambrose Channel and Fire Island lightships and at Sea Girt Lighthouse and will operate on a wave length of 1,000 meters, the international standard for such signals.

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IN compiling a code dictionary for use in radio telegraphy an English concern included about 3,000 technical words used in connection with wireless telegraphy and telephony.

THE Wallingford, Conn., Radio club was formally organized on June 1, at a meeting held at the home of E. Faucault, North Orchard street. William E. Kane was elected president and Raymond W. Bartek, secretary.

AMALGAMATION of all amateur radio associations in the Pacific Northwest was proposed at the banquet of the North-Western Radio Association of Portland held June 26 in the quarters of the East Side Business Men's Club, Portland, Ore. The purpose was to make amateur radio activities in this section of sufficient strength to combat legislatively the encroachments upon the amateur field and influences restricting the amateur.

About 125 radio amateurs from Portland, Seattle, Tacoma and other cities were present at the banquet. The chief speakers were Dr. A. H. Labby, president of the Portland body; Alvan Stenso, president of the Tacoma amateurs, and J. Grant Hinkle, secretary of state of the state of Washington. Mr. Hinkle outlined action to obtain recognition by law-making bodies.

The Tacoma delegation of 17 members had with it three women operators—Miss Margaret Klieber, Miss Winifred Dow and Miss June Harkness. All of them have operating sets of their own and conduct experimental work for pleasure.

Two other visitors who received special attention were Sergeant Paul Andert. 91st Aero Squadron, and Sergeant Neville Benoit, 57th Coast Artillery Corps, both stationed at Camp Lewis with the corps of flyers doing forest patrol.

Also present was Henry N. Esterly, 11 years old, of Hillsdale, supposed to be the youngest radio operator west of the Rockies, if not in the whole country.

THE regular meeting of the QRV Radio Association of Uniontown, Pa., was held at the Municipal building, Uniontown, recently. Several short addresses were made by members. Following the business meeting refreshments were served. A large number of amateurs of the vicinity attended.

RENVILLE H. McMANN of New York City, who is a member of the Executive Radio Council of the Second District and Secretary of the Radio Club of America, has been appointed Manager of the Radio Department, Federal Telephone and Telegraph Company of Buffalo.

A WIRELESS message addressed to all amateur stations in the second corps area, asking for the co-operation of operators in securing candidates for the "Red" Citizens Military Training Camp, which will be held at Plattsburgh for one month beginning August 7, was sent out recently by the Government radio station at Fort Wood, New York Harbor.

The message had a two-fold purpose, the first being a test as to whether or not all of the stations, or a majority of them, can take a Government message and act upon it, and the second being that of securing candidates for the camp among the wireless operators and their friends, all of whom would probably try to qualify as wireless operators or officers of the signal corps if the country were to become involved in another war.

All amateurs were requested to report back whether or not they succeeded in getting the whole message "clear." Reports were made by letter or radio to Major Harvey H. Fletcher, recruiting adjutant, Second Corps Headquarters, Governor's Island. The area covered by the message comprised the States of New York, New Jersey and Delaware.

THE first National Convention of the American Radio Relay League will be held at Chicago, August 30 to September 3, inclusive. An exhibit of apparatus by manufacturers and dealers has been arranged in conection with the convention, and the Broadway Armory will be used for this purpose. A programme of interesting events has been arranged for the five days of the convention, and a banquet will be held on the night of September 3rd, the final day of the convention. The affair is under the administration of the Chicago Executive Radio Council.

I NOTICED your article in July WIRELESS AGE regarding the City Council action in Salem and must disagree with you that the ordinance as passed states that the city electrician will grant a permit when equipment is installed to conform with National Electric Code. If the ordinance read this way we would offer no protest. Further, I do not claim that it is almost impossible to operate transmitting apparatus in Salem under these conditions, but that it places the granting of permits in the hands of the city electrician without specifying what regulations must be lived up to, and therefore giving him the privilege of rejecting applications if he has a personal feeling against any amateur.

You state that it is understood that the action of the City Council was based upon complaints of disturbances on the regular house lighting lines. We have been unable to find a single instance of such a complaint, and the city electrician has stated to a local electrical contractor that he did not urge the passage of this ordinance, does not know anything about wireless, and does not want to. You can therefore see why we object to the ordinance as adopted.—F. Clifford Estey.

THE Scott High Radio Club, Toledo, Ohio was organized seven years ago by a small group of local radio enthusiasts. During the early struggle of the club various members went before the Board of Education of this City and secured money to buy a radio outfit. This served to equip the station with a good receiving set. The transmitter consists of a one-half kilowatt "Hy-tone" set. A two and one-half kilowatt non-synchronous set has also been secured. The station set is not now being worked, however. Meetings are held every other week in the radio laboratory of Scott High School. A program is always presented by members of the club or some outside expert, after which discussions take place on subjects that are interesting to the members. At a recent date we had a discussion on Einstien which lasted for three hours and the club has not come to a conclusion yet.

Several innovations have been tried this year which have turned out particularly successful. The club has made several inspection trips to various plants about town such as power houses, telephone exchanges, electric manufacturing companies, etc. These trips have been a boon to the club and have always been well attended. We recently staged an open meeting to which the public was invited, that resulted in an autdience of about three hundred. These were assembled in the Scott High Auditorium, where we performed various experiments for them. The head-liner was

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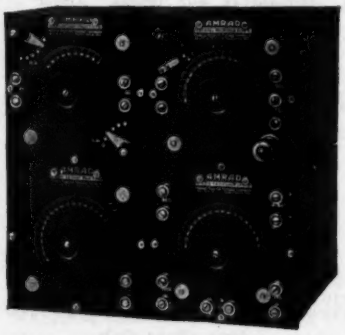

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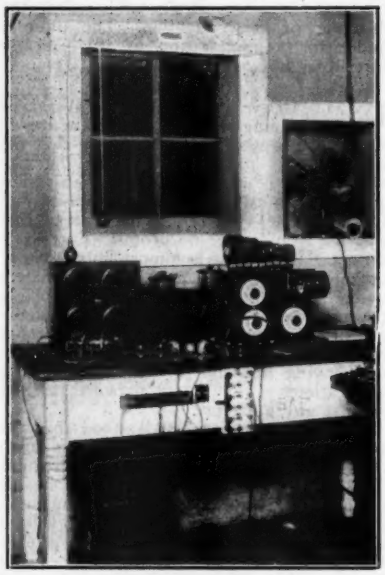
an exhibition in radio telephony. A two-bulb transmitter about two miles and a half away and a two-step amplifier together with a large magnavox for receiving at the school was used. The music and speech was heard clearly all over the auditorium. The history of electricity was illustrated by means of experiments and the use of a Tesla coil.

At the recent annual election, William P. Van Behren was re-elected president for his third term. The rest of the officers are as follows; Robert Tiedeman, vice-president; H. Matzinger, censor; H. I. Wisterman, secretary; Harold Polson, treasurer; Sherman Reward Hawley, sergeant-at-arms. These officers are workers and the club expects to do big things during the next season.



Amateur radio station 5AE owned and operated by Louis Peine, Houston, Texas. The large porcelain base d. p. d. t. switch on the front of the table is used to change the detector and two stage amplifier over from either the long or short wave set. This is the only change necessary.

THE auditorium of the Y. M. C. A. in Buffalo was the scene of an interesting demonstration recently of wireless telephony for the purpose of interesting young people in this novel form of communication. The necessary instruments were set up on the stage of the auditorium and a temporary aerial was run from the roof. A number of musical selections were received, played by a Victrola in the home of Professor Charles Klinck, of one of the local high schools. His home is about two miles from the auditorium of the Y. M. C. A. After the musical program, Professor Klinck spoke briefly on several subjects, thus demonstrating the clarity of transmission of the human voice over the radiophone.

THE Springfield Radio Association, of Springfield, Mass., announces that on July 1st, and thereafter, the station's call letters will be changed to 1BWY.

THE practice of exchanging weather reports by wireless among vessels at sea is constantly increasing, says the Weather Bureau of the United States Department of Agriculture. A weather report was recently received from the captain of the British tank S. S. *Tascalusa*, covering the entire voyage of that vessel from Hongkong to San Francisco. Embodied in the report were weather reports received by wireless from other vessels along the route.

The practice of interchanging weather reports by wireless between ships at sea is perhaps more general at present in the North Atlantic than in the North Pacific Ocean. To meet the needs arising from the growth of this practice the Weather Bureau recently published a basemap embracing the western part of the North Atlantic Ocean, the Gulf of Mexico and Caribbean Sea designed for use in preparing weather maps on shipboard from observations received by wireless.

A MEETING of about 330 radio enthusiasts was held at the Parkesburg, Pa., Iron Company's Basket Ball Hall recently. An organization was formed and called the Chester County Radio Association. Mr. Horace A. Beale, Jr., the President of the Parkesburg Iron Company, and probably the most prominent man in Chester County, was elected president of the Radio Association. Mr. Beale then introduced Mr. H. G. Gawler of the Radio Corporation of America, who gave an illustrated talk on the use of vacuum tubes in radio operation and also on the methods of organizing an association. Mr. Gawler was followed by Prof. Lloyd M. Knoll of the Central High School, Philadelphia, whose talk was immensely popular. He spoke of the pleasure that could be derived from the study of radio telephony and telegraphy.

A practical demonstration of radio communication was then given by Mr. Thomas Appleby of Philadelphia, who picked up the time from Arlington and a concert as given at Mr. Beale's garage about a mile distant. In his demonstration Mr. Appleby used a Pathé amplifier for the first time in this section of the state.

Mr. Beale has one of the best equipped stations in the State. It is located in a building on his grounds especially made for the purpose. The call is 3ZO and every evening a concert is sent out from 8 to 8.30 o'clock. An operator is on duty up to 11 P. M. every night. Steel poles 200 feet high set in concrete, support the antenna, while zinc plates have been set in the ground between.

RADIO Station 9XM, the station of the Department of Physics, University of Wisconsin is another C. W. transmitting station which has done some remarkable distance work during the past year.

The transmitter is in daily use for broadcasting the weather forecast by radiophone on 800 meters wave length. With an antenna radiation of 1.8 amperes, speech is clearly understood every noon by several stations more than 200 miles away, equipped only with single vacuum tube receivers. At night a wave length of 370 meters is generally employed. With a radiation of 2.2 amperes, speech and music have been reported from Massachusetts, New Jersey, Texas, and numerous other states. Modulated C. W. telegraph signals, of course carry still better; but the greatest range can be obtained with straight continuous wave signals, using all tubes in parallel as oscillators.

This fundamental circuit employed, as shown on the accompanying sheet, is similar to the one used by the British Marconi Company in their airplane transmitters, and somewhat resembles the one used in the aircraft transmitters during the war. Its chief advantages are simplicity and ease of operation. A condenser keeps the high voltage direct current from the antenna and the main circuit, thus affording safety to the operator when making adjustments, and minimizing the danger of short circuits. The Heising system of variable vol-

Take a Lesson from Jack Dempsey

By concentration he has won his way to the top. What applies to boxing is equally true of any career.

During the time the champion was training at Atlantic City for his battle with Carpentier, Jack Dempsey spent many of his spare hours at a nearby radio station. He knew that he was to be the central figure in an event of international importance, but he had started on radio and he found time for serious study of the principles of the science of radio communication.

The world's champion recognizes the broad field of radio. His early interest was gained particularly through descriptions of the big trans-oceanic stations, especially the New York Radio Central Station, on Long Island, known as "The Promised Land." Dempsey has grasped opportunities—hence his success. And nobody knows better than he the great opportunity radio offers in the way of a successful future career.

"The Promised Land" is the name professional operators have given to the New York Radio Central Station, on Long Island. When completed, this station will be the largest and most powerful radio station in the world.

It will be equipped to work simultaneously with five other nations in widely separated and distant parts of the world, and will be epoch-making in the field of international communication.

Enrollments are coming in by every mail. Why aren't you one of the wideawake wireless men who have seen the new and greater opportunity opened to them by the Home Study Course, which is specially designed to land them one of the enviable jobs at the world's greatest radio station? NOW—not some later day—is the time to act!

A position at this station is the height of every operator's ambition, for it means unlimited opportunity to succeed and progress to higher, more responsible and better paying positions in the radio industry. So far as opportunity goes the successful future of these men is assured.

How about you?

This new home course of radio training, which has been developed for the benefit of those who cannot attend the Institute personally, is the same course used at the Institute. It includes everything from basic principles of electricity and magnetism, to actual operation of commercial radio equipment. It also includes the same textbooks used in the Institute classes, as well as a buzzer set of greatly improved design, with a variable automatic transmitter, for code practice.

The graduates of the Radio Institute of America enjoy a great and exclusive advantage in the close connection existing between the institute and the Radio Corporation of America, the world's largest radio manufacturing and commercial radio company.

Prominent executives in the radio field are former students of the Institute. The Radio Corporation employs thousands of men, in its executive departments, on ships and at shore stations and in factories and laboratories. A large percentage of these men are graduates of the Institute.

The Radio Institute of America has been an established and successful institution for over fifteen years. The year round average attendance in its classrooms is now 298 students per month. It has trained over 6,000 men, 95% of whom have successfully engaged in this new branch of science and industry.

You, too, can be successful in this new field if you properly train yourself by means of the Home Study Course of the Institute. Radio offers an unlimited opportunity for future advancement—why not take advantage of it. Write for our booklet and further details—*Now*.

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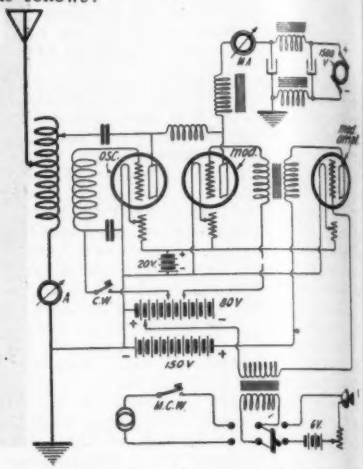
tage plate modulation is used requiring separate modulator tubes; these, in turn, are controlled through a single modulation amplifier bulb. to furnish the proper negative grid potentials, batteries are preferred over leak resistances, because of ease of regulation. A filter circuit renders the radiated wave entirely free from commutator hum.

A diagram of the set of 9XM station is as follows:



Filter condensers, 2 in series, 1 mfd each. Filter choke coils, iron core, about 1 henry each. Audio frequency choke coil, iron core, about 1½ henries. Grid condenser, and plate condenser, each about .0025 mfd. Tuning inductance, 75 turns, No. 8 wire, 6½-in. diameter. Grid coil, total 200 turns, variable by steps, 5½-in. diam. Wave length range, 350 to 2000 meters, approximately.

For damped wave telegraphy, the continuous wave is modulated by means of an elementary 500-cycle alternator, replacing the microphone and battery; signals are formed by interrupting either the modulation or the carrier wave. For continuous wave telegraphy, all power tubes may be used as oscillators; grid choke control is employed to interrupt the oscillations.

The power tubes employed are high vacuum pliotrons, constructed at the university under the direction of Dr. E. M. Terry. Great care is necessary in their manufacture, in order to obtain satisfactory results. The filament consumption per tube is about 12 watts, and its plate input about 53 watts at 1500 volts. The total input of the set is 300 watts. Two tubes as oscillators and three as modulators, are employed. The antenna current, phone with voice modulation, is 23 amperes, when transmitting continuous waves, 35 amperes.

A NEW amateur radio station has been constructed on what is known as "Radio Hill," at Los Angeles, Calif., and will become practically a school of radiography, with an equipment of two aerial towers, each 100 feet high and 250 feet apart. In addition, there will be a building housing two receivers and two transmission instruments, a power plant and facilities for operators and other station attendants upon the hill. The Department of Commerce already has granted the station, or club, a special license for a 375 meter wave-length, sufficient to enable the station to communicate over long distances.

The club, now with an active membership list of approximately 200, has just elected officers for manning the station. Those chosen are Lex B. Benjamin, H. Blaiser, V. M. Blitz, H. A. Duvall, R. P. McKinzie.

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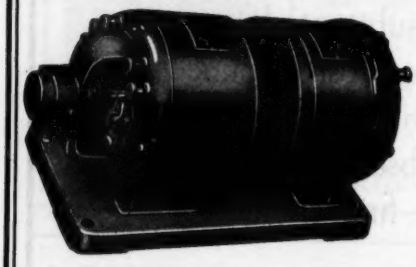

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20 to 2000 Watts
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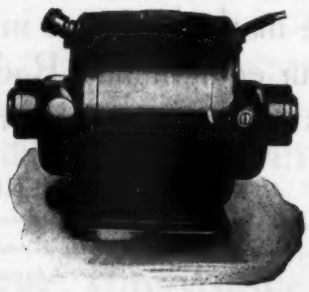

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in radio development an invitation to attend its meetings, held on the second and fourth Mondays of each month at 7.30 p. m., at Walker Auditorium, 730 South Grand avenue, Los Angeles, Calif.

THE amateur wireless station of R. V. Lohry, 1921 Irving avenue, Berkeley, Cal., was closed recently by Major J. F. Dillon, radio inspector for the Bureau of Navigation, Department of Commerce. Lohry had been sending messages on wave lengths greater than allowed amateurs and had also operated after his Government license had expired.

THE United Electric Company, of Springfield, Mass., has just recently completed the construction of a radiophone station and on the night of June 24 treated the amateurs of the country to some excellent music by radio. The first concert was given on June 25. The headliner of the musicians who took part was Mr. Maurice Freedman, violinist, who is well known in the concert world throughout the country. Concerts will be given regularly by radiophone from this new station.

ARGENTINE Republic, Darsena Norte, Buenos Aires, call letters LIA, sends time daily (except Sundays) on 800 meters, starting at 1:56 Greenwich Meridian time. A warning signal consisting of a series of dashes is sent from 1:55 to 1:55:50. The time signal is then sent as follows:

1:56:00 a dot (Time Signal) 1:58:25 dashes for 25 seconds.

1:56:15 dashes for 35 seconds 1:59:00 a dot (Time Signal).

1:57:00 a dot (Time Signal) 1:59:30 dashes for 20 seconds.

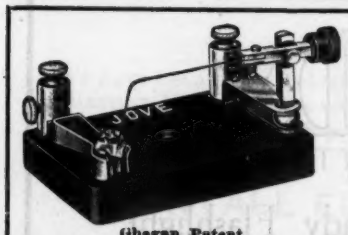
1:57:20 dashes for 30 seconds, 2:00:00 a dot Time Signal.

1:58:00 a dot (Time Signal) Duration of dot 0,25 seconds.

Brazil: Rio de Janeiro SOH sends out on 1800 meters the following time signal daily, except Sundays and holidays, at 24 GMT (midnight,) and 14 GMT.

Starting at 1:55:00 he sends the following "QST QST QST de SOH SOH SOH signaes horarios Rio Janiero"—as as as (Wait). A few seconds after 1:56:00 the letter O is sent six times (preparatory). At 1:57:00 the letter X is sent ten times and followed by three dashes the end of the last dash being the first time signal at 1:58:00. At 1:58:08 the letter N is sent five times the final dot of the letter falling on the end of each tenth second and is followed by three dashes the end of the last dash being the second time signal at 1:59.00. At 1:59:07 the letter G is sent five times the final dot of the letter falling on the end of each tenth second and is followed by three dashes the end of the last dash being the last time signal at 2:00:00.

The signals are sent by hand and should an error be made they are repeated a half an hour later. Very often the three signals do not coincide but the last is usually the most correct. The signals are audible up to 1500 miles.



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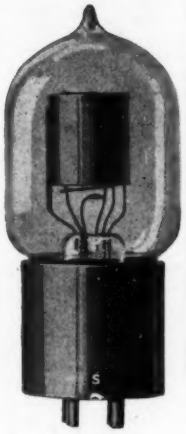
use A-P tubes for efficiency

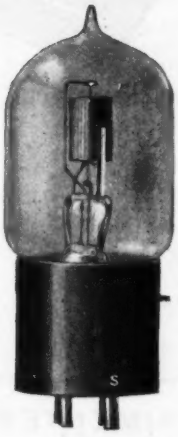
THE A-P VT AMPLIFIER-OSCILLATOR

—the amplifier used by the U. S. Navy. "Use the tube the Navy uses." Price $7.



THE A-P ELECTRON RELAY

—the most sensitive detector of spark signals known to the radio art. Price $6.



THE A-P TRANSMITTER TUBE

— an efficient undamped wave transmitter for use in radio-telephony. Price $7.50.

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"The last Vacuum tube you gave me I find it works the best I ever tried, it also oscillates fine, and sure can hear C. W. and spark stations loud and clear. The filament works around 3¾ volts"—Signed Stephen F. Pitoniak, 12 Valley Road, Albion Pl., April 25, 1921.

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The Demand for Good Wireless Operators far Exceeds the Supply

The N. Y. Wireless Institute will make you an operator—AT HOME—in your spare time—quickly, easily and thoroughly. No previous training or experience required. Our Home Study Course was prepared by L. R. Krumm, formerly Chief Radio Inspector, Bureau of Navigation, New York. Our experts are able to impart their practical and technical knowledge to *YOU* in an *easy to understand* way—will direct your entire course. The graded lessons mailed to you will prove so fascinating that you will be eager for the next one. The instruments furnished *free*, will make it as easy to learn the Code as it was to learn to talk. *All you will have to do*, is to listen.

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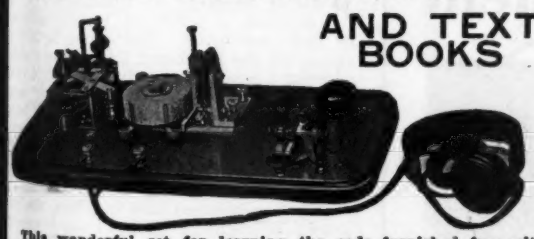

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This wonderful set for learning the code furnished free with our course.

We furnish free to all students, during the course, *the wonderful receiving and sending set exactly as produced in the illustration.* This set is not loaned but *given* to all students completing the Course.

The Transmitter shown is the celebrated *Omnigraph* used by several Departments of the U. S. Government and by the leading Universities, Colleges, Technical and Telegraph Schools throughout the U. S. and Canada. Start the *Omnigraph*, place the phone to your ear and this remarkable invention will send you Wireless Messages, the same as though you were receiving them through the air, from a Wireless Station hundreds of miles away.

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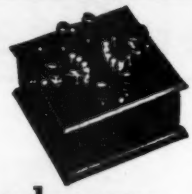
TRESCO TEN $ TUNERS



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Assemble them and save money

11	Plate	$1.80
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If you want us to assemble them for you add $1.00, plus P. P., to above prices. Shipping weight 2 lbs.

10c brings a wonderful catalog of 16 pages. 100 testimonials and freak hook ups for our tuners

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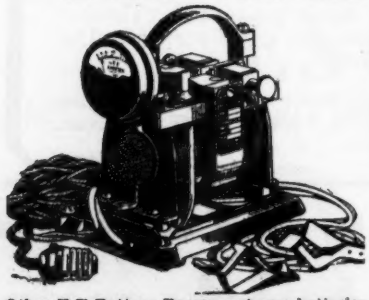
WIRELESS OPERATORS, EXPERIMENTERS, CAR OWNERS, STORAGE BATTERY USERS

10c CHARGES YOUR BATTERY AT HOME WITH AN F-F BATTERY BOOSTER



and your Wireless Station will never be closed because of a discharged battery. Is it not gratifying to feel that your filament battery will always be ready when you want it and that you will never have to give up in disgust when working a distant station? A Storage Battery kept fully charged lasts longer and everything depending upon it works better, which is the secret of perfect battery service, and a Booster insures this. Do not run the risk of ruining an expensive battery, for it costs less to buy a BOOSTER than to be without one. The F-F Battery Booster is a Charging Apparatus, unfailing in its ability to deliver service day and night, is rugged and foolproof and requires no skill to operate. They charge automatically and operate unattended. Screw the Plug into a lamp socket, snap clips on battery terminals and watch the gravity come up. The Ammeter shows you just the amount of current flowing. Easily renewable and adjustable carbon electrodes rectify the current and last for thousands of hours. Everything is complete in one compact, self-contained and portable unit. The F-F Battery Booster is a Magnetic Rectifier for 105-125 Volt 60-Cycle Alternating current. Latest Models are—

Bantam Type 6 charges 6V Battery at 6 Amps **$15**
Type 16 charges 6 Volt Battery at 8 Amperes **$24**
Type 166 charges 6 Volt Battery at 12 Amperes **$32**
Bantam Type 12 charges 12V Battery at 5 Amps **$15**
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Type 1612 charges 12 Volt Battery at 7 Amperes **$32**
Type 1626 Combination Type charges both 6 Volt and 12 Volt Batteries at 12 and 7 Amperes **$48**

The larger ampere capacity Types are recommended for the larger batteries, or where time is limited. Shipping Weights Complete with AMMETER and BATTERY CLIPS, 11 to 15 pounds. Order from your Dealer, or send check for prompt Express Shipment. If via Parcel Post have remittance include Postage and Insurance Charges, or have us ship C. O. D.

Other F-F Battery Boosters charge batteries from Farm Lighting Plants and D C. Circuits. If not ready to order now, write today for Free Descriptive BOOSTER Bulletin No. 34.

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Offices & Works: Cleveland, Ohio, U. S. A. Canadian Representative: Battery Service & Sales Company, Hamilton, Ontario.

Quality Radio Equipment

New Grebe Portable Radio Station Type KT-1

Ideal Vacation Outfit

Especially Adaptable and Efficient for Boy Scouts, Campers and Tourists

Absolutely the newest and neatest combination Transmitting and Receiving Portable Outfit on the market. Complete with Grebe CR-5 Receiver, Transmitter, Vacuum Tubes, Batteries and Head Set in attractive and durable case. Weight 24 lbs. Complete.. **$175.00**

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Montevideo, call letters CWA, sends hydrographic reports and warnings in both Spanish and English, on 750 meters at the end of every fourth hour. The normal daylight range of this station is 250 miles.

AN important change in the method of giving the regular Friday evening radio telephone concerts for Cleveland, O., radio amateurs is announced by A. G. Spiller, president of the Cleveland Radio Association, under the auspices of which the concerts are given.

Beginning with this Friday evening, these concerts in the future will be given in two sections, one-half by an operator in the western part of the city and the other half by an East Side station.

This change is made to provide entertainment for amateurs who are not equipped with the modern vacuum tubes but use only what is known as the crystal detector. With this type of detector, radio telephone messages can be picked up only at short distances. By giving the concert in the way outlined, amateurs in practically every section of the city can enjoy at least half of the weekly entertainment.

The first half of the programme on July 1 was sent out by Norman M. Kranz of 4383 W. 28th street, whose station is 8-AFO. H. H. Hurd of 3197 Noble road, East Cleveland, gave the last half of the concert.

More than a score of recruits to the ranks of Cleveland amateurs have set up stations within the last month so they could enjoy this weekly entertainment and demonstrate their progressiveness to their friends.

AMONG the novel features of the carnival at the Jefferson Junior High School at Rochester, N. Y. recently, was the music furnished by radio for dancing in the library. The equipment used to receive the music was loaned and installed by the Triangle Radio Society. The radiophone station of Hugh Stevenson furnished the music. The station is approximately three miles from the school.

AN illustrated talk on radio was given recently at the Radio Club of the Central High School, Broad and Green streets, Parkesburg, Pa., by Thomas Appleby, radio engineer. The radio station at Central High School, which was discontinued during the war, will again be in operation soon. A class of fifty boys meets weekly and soon will open a station with a 150-mile radius. Prof. L. M. Knoll, of the physics department, is in charge of the radio work at Central High.

RADIO amateurs of Cleveland, O., are enjoying a series of weekly concerts by radio telephone. The concerts are arranged by the Cleveland Radio Association. Cleveland people generally have little realization of what is passing over their heads every evening in the way of radio telephone conversations and concerts from a dozen or more stations built and operated by radio amateurs, asserts A. G. Spiller, president of the Cleveland association. Under the arrangement now in effect, the programs broadcasted every Friday evening consist of vocal and instrumental numbers provided by musical talent in the city. Stations in various parts of the city will send out these concerts between 8:30 and 9:30 in the evening. Amateurs having a radio receiving apparatus have "guest nights" at their homes, so their friends may be initiated into the mysteries of radio and at the same time be delightfully entertained by some of the leading musical artists in the city at the same time.

ALPHA Chapter, Alpha Delta Alpha Radio Fraternity of Coe College, Cedar Rapids, Iowa, announces the affiliation with the installation of Beta chapter at the State University of Iowa City, Iowa. The radio fraternity was founded at Coe College, Cedar Rapids, Iowa, in September, 1920, by 18 commercial radio engineering students. After being granted a charter by the college, the chapter was legally installed the following month with a membership of 25 men.

The radio fraternity recently sponsored the Iowa State Radio Convention which was held at Coe College, Cedar Rapids, Iowa. Reports from all concerned indicate the convention a great success. The main achievement was the establishment of the Iowa Radio Relay League, for the benefit of amateurs of the state.

THE Hudson City Radio Club, Hoboken, N. J., which meets at 91 Franklin street, Jersey City, has installed the following officers: Harry Bremer, president; Walter Moeller, vice president; Vincent Gilcher, secretary; Andrew Lutze, treasurer; Herbert Stout, sergeant-at-arms. The purpose of the club is to bring together radio amateurs of Jersey City and vicinity. Lectures on different wireless apparatus will be given by representatives of the Radio Corporation of America and the American Radio and Research Corporation in the near future. Applicants for membership must be at least fifteen years of age. Application blanks may be obtained from H. Bremer at the meeting rooms.

A NUMBER of Jefferson City, Md., young men have organized a radio club. Among the members are Henley Blair, Robert Sullivan, Sam Blair, Victor Vetter, Wendell Manchester, Carl Linhoff, Allison Horner, Roy Garrett, Jack Giesecke and Rosser Austin. The club recently purchased apparatus which enables members to hear music sent out by wireless telephone from Eureka, Illinois, and other places in the East. Willis Corwin, a student in the Engineering school of the State University, also conducts a wireless telephone and communicates with the club nightly.

A NEW organization to be known as the Hamilton Radio Club, was formed at a meeting in the office of the Chamber of Commerce, Hamilton, O. Shuler Doran was elected president, Cecil Hopkins, vice-president and J. A. Stinson, secretary-treasurer. Miles Bruning was appointed chairman of the program committee. The new radio club will assist the Government radio inspectors in enforcing the regulations governing wireless operation and in other ways promote and protect the amateurs. Club membership fees will be used for experiments and subscriptions to the various radio magazines. Regular business meetings will be held on the first Tuesday of each month, at the Chamber of Commerce. Experiments and demonstrations will be held at the call of the program committee.

A COMPETITIVE examination will be held beginning August 22, 1921 for appointment in the grade of Second Lieutenant, Signal Corps, Regular Army. Candidates must be graduates, or members of the senior class, of educational institutions maintaining four-year courses of instruction in electrical engineering and physics and conferring the degree of bachelor of science in these two courses. Upon receipt of reports of examining boards decision will be made by the Chief Signal Officer as to whether or not the institution and the course therein qualify for appointment in that branch of the service.

Full particulars relative to both the pre-

The Door Is Open to You

THERE is always room in the great field of Radio for the man of determination. Our short courses afford you an easy access. A trained corps of practical Radio men is at your service to help you make good. Make your spare evenings work to your profit by investing them in this attractive study.

TO THE OUT-OF-TOWN MAN we offer a real home in our comfortable dormitories, as well as complete recreational facilities. Rate very moderate.

Make reservations now for Fall Term

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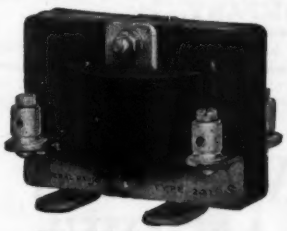
REBUILD YOUR SET FOR RESULTS

Are you planning to rebuild your receiving or C-W transmitting set this fall? If you are, you will want to put the best transformers available into it.



Type 231 Transformer

Our Types 231A Amplifying and 231M Modulation Transformers have been designed to get the maximum possible results from the Radiotron UV201 and 202 tubes respectively.

The operation of amplifying and modulation transformers is explained in free Bulletin 907W. Send for it today.

PRICE — EITHER TRANSFORMER, COMPLETELY MOUNTED . . . $5.00

Direct or from your local dealer

GENERAL RADIO COMPANY—Cambridge, 39, MASS.

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UTTMARK'S NAUTICAL ACADEMY RADIO SCHOOL

NEW YORK BOSTON

Offers a thorough course in all branches of wireless telegraphy. Radio Operators earn at the start $125.00 per month, and first class board, etc., free. Our school prepares you for your license in three to four months. Positions guaranteed to first grade licensed operators.

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Pacent Universal Plug

PRICE $2.00

THE ONLY PLUG FOR RADIO
NO CONNECTIONS TO SOLDER
CONNECTED IN A JIFFY
ESSENTIAL FOR MODERN RADIO
FOR *TRANSMISSION* AND *RECEPTION*
APPROVED BY THE NAVY DEPARTMENT
USED BY COMMERCIAL COMPANIES
ENDORSED BY FOREMOST AMATEURS
OBTAINABLE FROM YOUR DEALER

Dubilier Universal Condenser

PRICE $2.00

IN CAPACITIES FROM 0.00025 TO 0.01 MFD.
FOR *TRANSMISSION* AND *RECEPTION*
ESPECIALLY DESIGNED FOR C. W.
WILL CARRY ONE AMPERE AT 1000 VOLTS
RUGGEDLY CONSTRUCTED
HAS CONSTANT CAPACITY
APPROVED BY OUR GOVERNMENT
EASILY MOUNTED ANYWHERE
OF UNIVERSAL RADIO USE.

We shall be pleased to send you bulletins describing the above and our other products on receipt of five cents in stamps.
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DEALERS—Write immediately for our liberal discounts.

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MORE SENSITIVE THAN THE EARS OF AN OWL

Ernest Thomson Seton, the naturalist, says owls have the most sensitive ears known.

Brandes Wireless Receivers are more sensitive—an improvement on Nature. The two telephones are perfectly matched in tone and this exclusive Brandes feature adds force to the supersensitive mechanical tympanums.

The minutest sound vibrations quivering through the air from out the far distances are caught and focussed into the clean, clear notes of the readable message—Brandes headsets getting it all, where other equipment gets little or none.

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BRANDES Matched-Tone HEADSETS

liminary and final examinations may be obtained by writing to the Commanding Officer of the nearest military post, or direct to the Chief Signal Officer of the Army, Washington, D. C.

Queries Answered

ANSWERS will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of one reader can be answered in the same issue. To receive attention these rules must be rigidly observed.

Positively no questions answered by mail.

H. D. P., Gainesville, Ga.

Q. 1. How many meters is 10 degrees equal to on a 43 plate variable condenser scale?

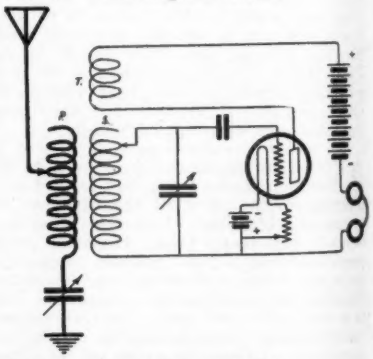
Ans. 1. Insufficient data. This depends on the circuit, aerial, ground and inductance employed.

Q. 2. Please publish a hook-up for a spark coil transmitter using 110 volts A. C., using some suitable resistance.

Ans. 2. This needs a considerable amount of experimenting to get the correct value of resistance for your particular coil. Suggest you use a salt water rheostat. Some very excellent data will be found in the "Wireless Experimenter's Manual."

Q. 3. Please give a hook-up for a short wave regenerative set using a loose coupler, tickler coil, radiotron, two variable condensers.

Ans. 3. See diagram below:



P. V., Jr., Amsterdam, Holland.

Q. 1. Can you give me a decisive remedy against air disturbances?

Ans. 1. I cannot give you any data simple enough to be of value in amateur construction.

Q. 2. And can you tell me whether or not a separative spool for little waves must be connected parallel with the large spool?

Ans. 2. I cannot understand your second question. Kindly send full particulars.

* * *

H. E. H., Chicago, Ill.

Q. 1. Is it necessary to have insulation upon the frame before wiring with the No. 18 wire.

Ans. 1. No.

Q. 2. Will this give good results over an area of approximately one hundred miles?

Ans. 2. Yes, with two steps of amplification.

* * *

C. K., Louisville, Ky.

Q. 1. Will you please give me a full description of apparatus used in a 2-step amplifier receiving unit?

Prize Contest Announcement

The subject for the new prize contest of our year-round series is :

Buzzer Modulation vs. Chopper Modulation

CLOSING DATE, :: :: SEPTEMBER 1, 1921

Contestants are requested to submit articles at the earliest practical date.

Prize winning articles will appear in the November issue.

All manuscripts should be addressed to the CONTEST EDITOR of THE WIRELESS AGE.

Buzzer Modulation vs. Chopper Modulation for the reduction of interrupted C. W. transmission with tube transmitters on amateur wave lengths, is a topic that should interest the amateur... What is your "dope" on it? Tell us about your experience. Prizes will be awarded for the best discussions. Articles should be illustrated by photographs or sketch of the apparatus and wiring diagrams.

PRIZE CONTEST CONDITIONS—Manuscripts on the subject announced above are judged by the Editors of THE WIRELESS AGE from the viewpoint of the ingeniousness of the idea presented, its practicability and general utility, originality and clearness in description. Literary ability is not needed, but neatness in manuscript and drawing is taken into account. Finished drawings are not required, sketches will do. Contest is open to everybody. The closing date is given in the above announcement. THE WIRELESS AGE will award the following prizes: First Prize $10.00; Second Prize, $5.00; Third Prize, $3.00, *in addition to the regular space rate paid for technical articles.*

Ans. 1. Two amplifying transformers; 2 V. T. sockets; 2 Radiotrons U. V. 201; 2 filament rheostats; one 6-volt 40-ampere storage battery; 2 blocks "B" battery, 45 volts.

Q. 2. Will it be all right to use ordinary city current (110v 60-cycle) for the plate voltage of the two amplifiers?

Ans. 2. Yes, but considerable experimenting with a filter circuit would be necessary. It should be rectified for best results.

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There are two kinds of amateurs, those who get real pleasure and satisfaction out of their radio work, by using dependable equipment, and . . . . the rest.

There are two kinds of dials, Corwin Dials and . . the rest.

The first class of radio men almost invariably choose Corwin Dials.

3" Dial, 75c—with knob, $1.30
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4 West Park St., Newark, N. J.

The Sound-Method for Memorizing the Code

For success in telegraphing the letters must be learned by their *sound.*

Each letter has a distinctive cadence or rhythm which is easily memorized by a few hours' practice.

Charts which show the telegraph alphabet in dots and dashes greatly handicap the beginner. A mental picture of the dots and dashes of each letter forms in the mind, and when a signal is heard, the beginner naturally tries to call up the *picture* of the letter. In practical telegraphy there is not time to do this, and the next signal is lost.

The charts attached give the key to the rhythm of each letter of the telegraph alphabets. It forms no picture in the student mind but, instead, a sound is memorized, like a bar of music.

The chart is particularly valuable in learning to *receive* which is many times more difficult than learning to send. An hour a day devoted to memorizing the distinctive *rhythm* of each letter will enable the student to send or receive a message in a few weeks.

The beginner is strongly advised not to practice with charts or books which show the actual dots and dashes. Once a *picture* of each letter is formed in memory it will be found difficult to send or receive in the telegraph alphabet properly—by *sound.*

WIRELESS PRESS, INC.
326-28 Broadway, New York

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THIS NEW WAY OF LEARNING THE CODE

is the easiest, quickest and most thorough ever devised for learning without instruments

If you want to learn the code—

If you want to "cinch" the signals you can't remember easily—

If you want to help some one else learn the code—

GET ONE OF THESE CARDS.

Don't try to teach the Ears through the Eyes

This system teaches the signals as they come through the Head Phones

Contain both Continental and American Morse—Printed on Celluloid
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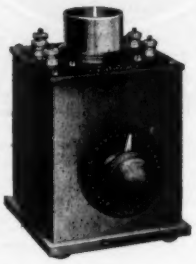

TAKE AN ACME Detector and Amplifier with you on your vacation. These instruments are the usual ACME quality applied to the needs of modern Vacuum Tubes. All leading dealers can supply you.

Compact
Efficient
Guaranteed
Reasonably priced.

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22½ Volt Batteries
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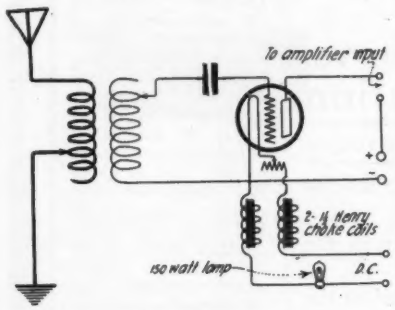
Q. 3. Will you please give me a hook-up using the following: 4,000 meter coupler, fixed condenser, 2 steps amplifier unit, grid condenser, phones, filament rheostat, "B" battery and city current for A battery and an audiotron potentiometer for controlling current?

Ans. 3. See following diagram:



P. G., Jersey City, N. J.

Q. 1. The natural wave length of an aerial; two wires, No. 14 bare copper, 45 feet long, spaced 2 feet apart. The lead-in is about 60 feet and the ground wire is about 25 feet.

Ans. 1. Approximately 95 meters for "T" type aerial.

Q. 2. The wave length of a tuning coil; 6 inches in diameter, 17 inches long and wound with No. 25 bare copper wire.

Ans. 2. Refer you to the Chapter on Radio Design in "Wireless Experimenter's Manual."

* * *

H. W. B., Jacksonville, Fla.

Q. 1. What is the wave length of an aerial containing 4 wires 150 feet long (2 feet apart), 50 feet lead-in, 25 feet ground lead, 40 feet high?

Ans. 1. Approximately 160 meters for "T" type and 210 meters for Inverted "L" type.

* * *

A. R., White Rock, S. D.

Q. 1. Is a Government license required for amateur radiophone having 200 meters wave length?

Ans. 1. Yes, absolutely.

Q. 2. Please give me a cheap but efficient C. W. hook-up for 200 meters.

Ans. 2. Refer you to the C. W. circuit in "WIRELESS AGE" for July, page 30.

Q. 3. What is the natural wave length of an aerial of the following dimensions: 4 wires 50 feet, 24 feet from ground, lead-in 30 feet long.

Ans. 3. 130 meters approximately for inverted "L" and 110 meters approximately for "T" type.

Q. 4. May ordinary V. T. tubes be used for telephone transmission?

Ans. 4. Yes, but power tubes such as the radiotron U. V. 202 5-watt tubes are specially designed for this work.

* * *

O. D. G., Rockland, Maine.

Q. 1. With Radiotron U. V. 200 connected as on page 274 of the "Wireless Experimenter's Manual," no plate current can be obtained either with electrolytic rectifiers or "B" batteries. There are no defects such as wrong or loose connections, defective apparatus, breaks, etc. The filament heating transformer will pass 6-volts through and the filament itself when hooked onto the rectifier passes excess current without lighting up. I used water resistances throughout. What causes this?

Ans. 1. There might be some trouble with the rectifying tubes in that they may not be lighted enough to rectify the A. C.

* * *

A. C. M., Fort Caswell, N. C.

Q. 1. What is the fundamental wave length and approximate length in feet of antenna to be used with the Western Electric Radio Telephone Set type B. C. 13A, complete with powerboard type B. D. I. A?

Ans. 1. 2oo meters, four wires 90 feet long, 3½ feet between wires 60 feet high. Of course these dimensions are only approximations as the wave length will vary with the conditions surrounding the antenna such as buildings, steel, etc., and also the materials in the earth and the topographical contour of the surrounding country. The only exact way is to put up the aerial and measure the wave length with a wavemeter.

Q. 2. Under good conditions what could be called the normal radiation of antenna?

Ans. 2. One to two amperes.

Q. 3. Under good conditions what is normal range of this set?

Ans. 3. Ten to fifty miles.

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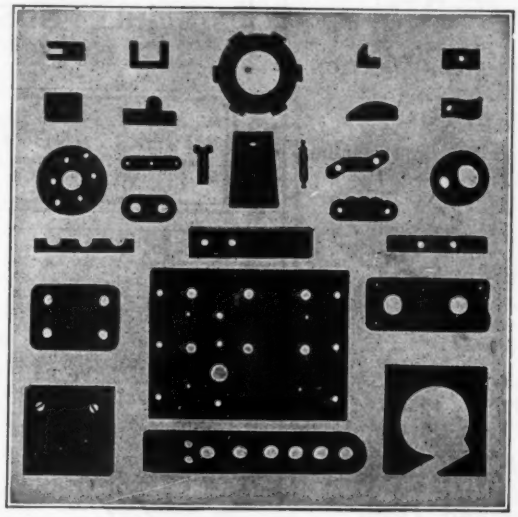

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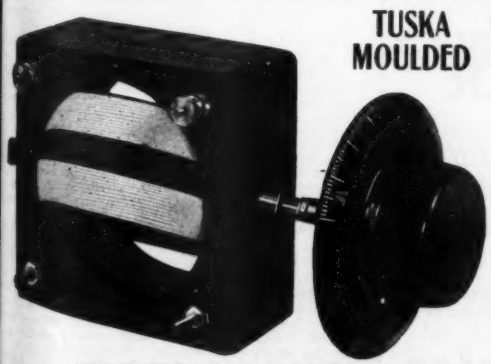

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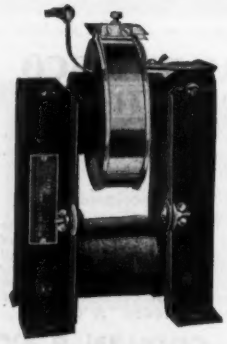

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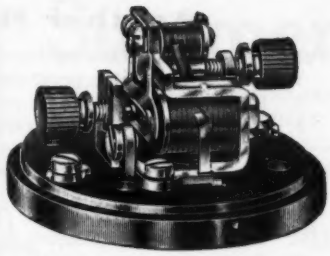

Illustration Shows Buzzer With Metal Cap Off

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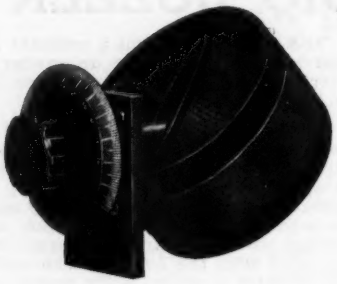

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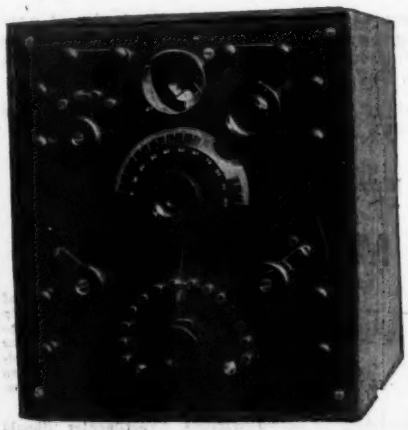

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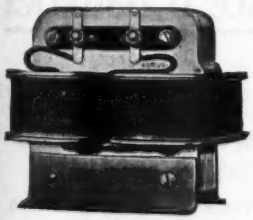

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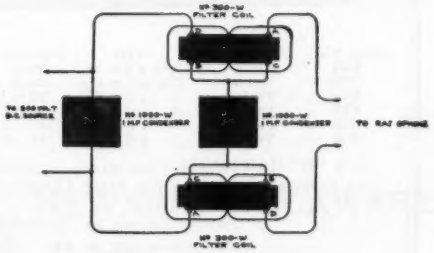

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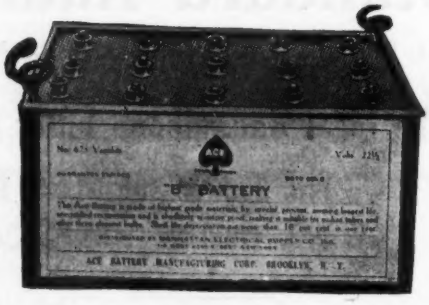

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Ace "B" Batteries

Dealers

Sell the "Best" with our Special Inducements

Write for Catalog No. 15

Cat. No.		Size	Voltage.	Hrs. Ser.	Taps	Lbs.	Price
623	Plain	2½ x 2 x 3⅝	22½	400		1	$1.25
623	Variable	2½ x 2 x 3⅝	22½	400	5	1	1.75
625	Plain	3 x 4 x 6⅝	22½	1400		5	2.50
625	Variable	3 x 4 x 6⅝	22½	1400	5	5	3.00
626	Plain	3 x 8 x 6⅝	45	3000		10	5.00
626	Variable	3 x 8 x 6⅝	45	3000	6	10	6.00

ACE "B" BATTERIES are made according to government specifications, and are especially adapted for Plate Circuit, Detector and Amplifying Tubes.

Guaranteed not to Depreciate more than 10% in one year when not in use. Absolutely Moisture proof.

A few of the dealers handling Ace "B" Batteries

Am. Electro Tec. Appliance Co., New York. Dave Killoch, New York.
Continental Radio & Electric Co., New York. Manhattan Elec. Supply Co., New York.
Dreyfuss Corporation, New York. M. Muller, Boston, Mass.
W. B. Duck, Toledo, Ohio. Vimy Supply Co., Toronto, Canada.
Whithall Elec. Co., Springfield, Mass.

ACE BATTERY MFG. CORP.

Phone Main 8373 44 COURT STREET BROOKLYN, NEW YORK

Distributing Agency will be given to right parties

BAKELITE-DILECTO

Manufacturers!

Wireless apparatus for commercial, experimental and amateur use has recently moved a considerable number of notches ahead.

Yesterday's Construction Doesn't Go Today

Handsome appearance must be combined with efficient working. The true enthusiast looks for both in the apparatus he buys nowadays.

This is particularly true of the insulation used. And the engineers and amateurs of widest experience have learned that when genuine

BAKELITE - DILECTO

is used, SATISFACTION is **SURE.**

Combine the popularity of this wonderful insulation with the best work you can do. Tell your customers that you use the genuine **BAKELITE-DILECTO**—and watch your sales grow.

BAKELITE-DILECTO WILL CUT YOUR MANUFACTURING COSTS—

because it comes in sheets, rods and tubes. This means the minimum of fitting work. It is waterproof, permanent and strong. We also manufacture **Vulcanized Fibre** and **Conite** for special insulating purposes.

Write us about your requirements. Our engineers will gladly show you how our products will solve your insulating problems

THE CONTINENTAL FIBRE CO.

NEWARK, DELAWARE

233 Broadway, New York.
525 Market St., San Francisco, Cal.
332 S. Michigan Ave., Chicago, Ill.
411 S. Main St., Los Angeles, Cal.
301 Fifth Ave., Pittsburgh, Pa.

Our Congratulations Upon a Big Achievement

THE news of the Carpentier-Dempsey championship bout was flashed to every corner of these United States by Radio Amateurs through their highly efficient relay organizations.

The National Amateur Wireless Association, through the courtesy of Mr. "Tex" Rickard, the promoter of the bout, transmitted bulletins broadcast from the ringside, for the benefit of the American Committee for Devastated France and the Navy Club.

The enterprising spirit and the highly efficient manner in which these bulletins were handled by Amateurs mark an epoch in Amateur Radio.

It was a big job done in a big way.

A great many of these Amateurs were fortunate in having in their stations the Grebe CR-5 Receiver. This receiver, with its range of 150 to 3,000 Meters brought in the bulletins on 1600 Meters in many parts of the Country.

It has afforded us a great deal of satisfaction in knowing that we were the only manufacturers to produce a receiver particularly adapted to this work.

The CR-5 proved its merit in this test and we are confident that whenever there is a big job for Amateur Radio in the future, this Receiver will be "on watch" in many more stations, and *there* with the results!

A. H. GREBE & CO., Inc.

78 Van Wyck Blvd. Richmond, Hill, N. Y

Manufacturers of

GREBE RADIO

Apparatus of Proven Merit